Beyond Beauty: Reexamining Architectural Proportion in the Basilicas of San Lorenzo and Santo Spirito in Florence

PROEFSCHRIFT

ter verkrijging van
de graad van Doctor aan de Universiteit Leiden,
op gezag van Rector Magnificus prof. mr. P.F. van der Heijden,
volgens besluit van het College voor Promoties
te verdedigen op dinsdag 15 november 2011
klokke 13:45 uur

door

Matthew A. Cohen
geboren te New York, USA
in 1962

Promotiecommissie

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Acknowledgements

The research presented here would not have been possible without the varied support of numerous individuals and organizations, including James S. Ackerman, Pietro Ruschi, Daniel L. Schodek, Eduard F. Sekler and Jorge Silvetti; the Soprintendenza per i Beni Architettonici e per il Paesaggio per le Provincie di Firenze, Pistoia e Prato for allowing me access to the basilica of San Lorenzo and the use of a lightweight mobile scaffolding from November 1991 through June 1992; Prior Mons. Angelo Livi and the chapter of San Lorenzo for their collaboration; the chapter of Santo Spirito and the Ufficio Belle Arti del Comune di Firenze, in particular Claudio Cestelli, Paolo Fiorini, and Paolo Ferrara, for granting me access to the basilica of Santo Spirito in June 1992 and permission to erect scaffolding therein; the Opera di Santa Maria del Fiore and geom. Paolo Bianchini, Responsabile del Ufficio Tecnico for permission to measure the Basilica of Santa Maria del Fiore and obtain access to the ballatoio and roof; the Graham Foundation for Advanced Studies in the Fine Arts for its generous support in 1991 and 2002; Washington State University, for awarding me a New Faculty Seed Grant from the WSU Foundation and the Office of the Vice Provost for Research in 2005; the Kunsthistorisches Institut in Florenz, for allowing me access to their library and facilities; Franceso Benelli, Caroline Elam, David Wang and Jack Wasserman for many useful and challenging comments on various portions of the text; and others including: Anja, Oronzo Brunetti, Nicoletta Carniel, Rudy Cocco, Deirdre Force, Kirsten Garz, Tommaso Gori, Phil Gruen, Amy Larsen, Eva Mussotter, Giacinto Russo, Carla Schmitzfurder, Michele Serviente, Matthias Feldmann, Stefano Guiducci and Ursula Winkler for their assistance with measuring and other aspects of this research.

I extend special thanks to the following three individuals: Chester H. Liebs, who taught me how to read the built environment, and thereby encouraged me to study architecture based on observation; Howard Burns, who recognized the potential of this research in an early stage and has advised and encouraged me throughout the long process of its development; and Caroline van Eck, my dissertation advisor who continues to challenge my understanding of architecture, proportion and aesthetics.

Finally, I thank Crystal Gartner, whose support and encouragement in so many ways has inspired me to think creatively.

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> "Per lequale tutte cose essendo io studioso & di voluptate infiammato di intendere il fetoso intellecto, & la pervestigatione acre dil perspicace Architecto, dilla sua dimensione, & circa il liniamento & la prattica perscrutandola subtilmente cusi io feci. // Uno quadrato collocato soto le columne, bine per lato diligentemente mensurai. Dallaquale mensuratione facilmente tuta la symmetria compresi dilla prælibata porta. Laquale explanando transcorrero brevemente."
>
> —Francesco Colonna, *Hypnerotomachia Poliphili*, c. 1467[1]

1. Introduction

The basilica of San Lorenzo has a serene, orderly appearance that tends to make one think of geometry and mathematics, especially when it is compared with the medieval buildings that preceded it (Figure 1-1). Consequently, for over two centuries architectural historians have praised the proportions of the basilica. In the first volume of the *Encyclopédie Méthodique* of 1788, Antoine-Chrysostome Quatremère de Quincy remarks that "other than the beauty of the plan, one admires the beautiful proportions of the columns, and the purity of the profiles and entablatures."[2] While William Henry Goodyear, writing just over a century later, contends that compared with the "…picturesque cathedrals of the Middle Age…" the churches of the early Renaissance, of which he cites San Lorenzo as a representative example, "…cannot claim an equal interest…," he allows that they do have one redeeming quality: "…their sense of proportion and of system is a most interesting illustration of the modern spirit of fifteenth century Italy."[3] Emilio Lavagnino, in his condensed Brunelleschi guidebook of 1931, praises the "…geometrical regularity…" of the nave that reveals a "…necessity of rhythm…" and a "supreme all-encompassing Tuscan elegance."[4] These accounts present architectural proportion as an aesthetic problem.[5]

In an influential article of 1953, Rudolf Wittkower describes the basilica as having "metrical discipline," and associates its proportions with the mathematics underlying Brunelleschi's invention of scientific perspective drawing.[6] Ever since, most scholars have expressed *de rigueur* praise for the orderly beauty of the basilica using quantitative, mathematical terminology. Thus the fourth edition of *Helen Gardner's Art Through the Ages*, published in 1959, departs from Gardner's earlier editions by describing the San Lorenzo proportions in terms of ratios, and concluding that early Renaissance architects strove "…to express simple, mathematical relationships in their buildings."[7] H. W. Janson, in his *History of Art* first published in 1962, similarly concludes, after a lengthy discussion of the San Lorenzo proportions, that "…the harmonious, balanced character…" of the design is a product of "…proportional ratios expressed in simple whole numbers."[8] In his slim *Pocket Guide to Architecture* of 1980, Patrick Nuttgens also summarizes what appears to be his aesthetic assessment of the basilica in the following quantitative terms: "S. Lorenzo is notable for the precision of its proportions."[9] In their architecture survey textbook of 1986, Marvin Trachtenberg and Isabelle Hyman perpetuate this Wittkower-inspired convention when they note the "lucid…mathematical ordering of space" in San Lorenzo.[10] Only Howard Saalman, in his 1993 Brunelleschi monograph, provides quantitative, if largely inaccurate, discussions of the San Lorenzo proportions that are mostly free of aesthetic assessments.[11] These post-1953 accounts present architectural proportion as a mathematical problem, usually with aesthetic implications.

The preceding exerpts from the San Lorenzo literature indicate that the persistent scholarly association of this basilica with the subject of architectural proportion stems from a longstanding scholarly consensus that the basilica possesses orderly beauty, and that proportion is somehow a cause or explanation of it.[12] We see that scholars have framed architectural proportion either as an aesthetic problem, a mathematical problem; or both simultaneously, when they have assumed that qualitative aesthetic assessments can have quantitative causes (see Epilogue). These aesthetic judgments and attendant mathematical interpretations of architectural form, however, are merely modes of visual description. They draw scholarly attention away from the value of architectural proportion as an historical problem. They focus primarily on the aesthetic judgements of the *observers* (i.e., of *us*, the historians) in various periods in history, including the present, rather than on the knowledge and interests of the *original architects, patrons and intended audiences* of the basilica of San Lorenzo (i.e., of *them*, the subjects of the historians' research).[13] They thus have limited value in the study of architectural history.

The present study reexamines the problem of architectural proportion in the basilica of San Lorenzo following a rigorous new methodology that combines observation-based and documentary evidence for the purpose of identifying the proportional intentions of its fifteenth-century creators. It finds that the proportions of this basilica are indeed extraordinary, but for reasons different than previous scholars have believed. This study analyzes the proportions of the basilica with greater quantitative precision than any previous study, and demonstrates that carefully-crafted *sets of proportions* expressed in the measurements constitute mental constructs that communicate non-visual, iconographical content. This study thus reframes the subject of architectural proportion as part of the rhetorical, rather than visual, structure of architecture. Like Francesco Colonna's investigation of an ancient portal recounted in the epigraph above, this study begins by measuring the proportions of an arched portal, and uses the resultant measurements as tools with which to probe the “fertile intellect” of the architect; and indeed that intellect, rather than the physical products of its labors, is the ultimate subject of this study.

1.1 Definitions

Architectural proportion is part of the rhetoric of architecture both as a mode of communication *through* architecture and *about* architecture. Thus, in the first case architectural proportion is a subject of study, such as when an architect uses a particular set of dimensions to form a number progression that communicates iconographical content; and in the second case it is a tool with which to study, such as when the architect or a later observer uses numbers to describe physical proportions in purely mathematical terms. As a rhetorical tool, the idea of architectural proportion requires clarification not only because architects often understood it differently than did later observers of their buildings (i.e., communication through vs. about architecture), but because both the word proportion, at least in English and the Romance languages, and the concept of proportion each simultaneously signify two fundamentally opposed ideas. In 1914 Geoffrey Scott elegantly summarized this problem as follows: “It was realised that ‘proportion’ is a form of beauty; it was realized that ‘proportion’ is a mode of mathematics. But it was not realized that the word has a different bearing in the two cases.”[14] Thus, when architectural historians use the word proportion, the meaning is often unclear to both author and reader alike.

When Quatremère de Quincy writes of the “beautiful proportions of the columns” of San Lorenzo, or when Goodyear praises the “sense of proportion” in early Renaissance churches, the modifiers that precede the word “proportion” in both cases leave no question that proportion signifies architectural beauty. What, however, could Nuttgens mean by the “precision” of San Lorenzo’s proportions in the passage quoted above? If he were referring to proportions solely in the mathematical sense, the comment would be redundant and undescriptive, since proportional ratios are by definition precise. He could not be referring to the precision with which the proportions were constructed in accordance with the architect’s specifications, since no such specifications have come down to us, and since Nuttgens had no way of knowing with quantitative precision what the proportions of the basilica are.[15] Nuttgens includes no modifiers, such as “precise-looking,” to denote proportion as an aesthetic assessment. Rather, he seems to mean *both* that the basilica looks orderly—presumably in a beautiful way or he would not have made the comment—and that the assumed presence of precisely-executed mathematical sequences in the dimensions of the building must be the cause of this appearance. Thus, he seems to be referring *simultaneously* to orderly beauty and mathematical proportions. The same ambiguity may be observed in all the post-1953 remarks about the San Lorenzo proportions quoted above.

The problem with this qualitative/quantitative ambiguity inherent in both the term and concept of proportion is that, as anyone who has ever measured an orderly-looking building knows, mathematically regular proportions are not necessary preconditions for an *appearance* of orderly beauty in architecture—and indeed, mathematical regularity is as often associated with architectural monotony as with beauty.[16] Thus, mathematical regularity cannot logically constitute a basis for aesthetic judgment. Indeed, mathematical regularity cannot even be perceived unless it is identified through measurement since the naked eye, unaided by measuring instruments, is not capable of perceiving metrical order with precision. If it were, human beings would not have invented measuring instruments. Therefore, architectural proportions cannot be objectively described using quantitative terminology (such as "mathematical" and "science" in the preceding quotations) unless they have first been measured. Furthermore, invisible iconographical devices such as symbolic numbers expressed in building dimensions must also be unrelated to architectural aesthetics, for they can only be apprehended by the intellect, through the intermediary of language.[17]

Since the word proportion, which I am obliged to use in this study for lack of any suitable substitute, by convention carries an aesthetic connotation and thus the potential to create confusion as to my purpose and conclusions, I provide the following definitions to separate aesthetics from architectural proportion. With my verbal analytical tools thus sharpened, I will study architectural proportion as a non-aesthetic historical problem.

<u>Proportion-1 (Ratio), Proportion-2 (Beauty), Proportion-3 (Sets of Proportions) and Proportion-4 (Proportion in General)</u>

As elucidated by Scott above, the word proportion, as commonly used in his day and ours, has two main meanings, one quantitative and the other qualitative.[18] The quantitative meaning denotes a mathematical ratio, such as 2:3. Typically, however, the word connotes the broader qualitative meaning, which appears to have entered the English language in relation to architecture with Ephraim Chambers's 1723 translation of the French *Traité d'architecture* of 1714 by Sébastien Le Clerc: "By Proportion I don't here mean a Relation of Ratios as the Geometricians do; but a Suitableness of parts, founded on the good Taste of the Architect."[19] These two meanings are unrelated and opposite to one another because the first, which I will call "proportion-1," is an abstract quantitative comparison; while the second, which I will call "proportion-2," is a qualitative aesthetic assessment of an identified object. In this study I will always use the word proportion with sufficient context to indicate whether the quantitative or qualitative meaning is intended. For example, an unmodified reference to the proportions of a column would signify the quantitative, width-to-height ratio that the column embodies (proportion-1). In such a case, due to the dimensional complexity of entasis, I would specify the height above the ground at which the column width was measured. Conversely, when I intend the qualitative sense of the word (proportion-2), I will use appropriate modifiers, such as the "more robust proportions" of the Santo Spirito columns compared with those of San Lorenzo, in order to make clear the aesthetic nature of the observation.

While this study avoids discussion of proportion-2, it requires a term that is more inclusive than proportion-1. Architectural proportion as an historical phenomenon is a rhetorical construct that combines multiple geometrical, numerical and arithmetical relationships, rather than just one as proportion-1 (a ratio) denotes.[20] The term "proportional system" has proven ill-suited to fill this role because it is laden with distracting preconceptions.[21] The word "system" implies a dynamic, quantitative mechanism that leads to a result, and many scholars tend to assume that the result of proportional systems is beauty, due to the aforementioned dual meaning of the word proportion. Furthermore, the word system can misleadingly imply that the subject under consideration is intensely scientific and mathematical, when in fact sets of proportions in historic architecture typically involve only rudimentary geometry, number theory and arithmetic. To supplement proportion-1, therefore, I will use the term "set of proportions," or "proportion-3," to denote:

> A group of geometrical, numerical or arithmetical correspondences between important dimensions throughout a building or major part thereof, placed there by the architect with the intention of imbuing built form with desirable qualities, physical or otherwise.[22]

Since this definition requires that a minimum of two proportional correspondences be present, it provides a useful way to distinguish intentional proportions from coincidental ones. For example, many individual proportions (proportion-1) that may seem to be historically significant, such as a root-2 rectangle ($1{:}\sqrt{2}$), might appear in a complex building through mere dimensional coincidence rather than the intentions of the architect, especially if the researcher includes numerous points of measurement in the analysis and leaves generous allowance for assumed construction error. A geometrical proportion that is *simultaneously* expressed in terms of whole numbers of the local unit of measure, however, may be considered less likely to be coincidental than one that lacks such simultaneous numerical expression.[23]

This definition is only useful, however, when the historian presents evidence that the individual proportional correspondences that make up an identified set of proportions were indeed conceived separately by the architect, and are not merely the historian's alternative interpretations of a single proportional correspondence. For example, if documentary or other evidence were to indicate that an architect laid out a church floor plan in conformance with proportions that he understood to be those of a square-and-a-half rectangle, an historian would not, according to this definition, be able to assume that the architect simultaneously understood the floor plan proportions in terms of the whole-number ratio 2:3, nor an harmonic diapente ratio (2:3), nor any other descriptions of the proportional ratio in question other than those that could be documented as representing the architect's intentions. The kinds of evidence that might be acceptable for such an identification will be discussed below. This definition furthermore requires an acknowledgement on the part of the historian that complexity and irregularity are the normal conditions of architecture, and that consequently, any intentional sets of proportions in an executed work are likely to contain deviations from the architect's original intentions due to construction errors or other contingencies. Some intended sets of proportions, therefore, may be impossible to identify, and thus lost to history.

In addition to "proportion-1," "proportion-2," and "sets of proportion" (proportion-3), for convenience I also allow for a fourth mode of discussing proportion, which I will call "proportion-4." This mode includes general references to the subject of architectural proportion that leave intact the quantitative/qualitative ambiguity that typically accompanies the term proportion today. My reference to proportion in the title of this study, for example, and in the second sentence of this introduction before my presentation of the sub-definitions noted above, fall into the category of proportion-4. This mode is used sparingly in this study.

1.2 The Wittkower Paradigm

The belief among most scholars today that certain proportions (proportion-1) contribute to widespread perceptions of orderly architectural beauty (proportion-2) traces back at least as far as the fifteenth century, but became formalized in the scholarly literature in the writings of Rudolf Wittkower.[24] We have seen that with an article of 1953 Wittkower effectively branded the basilica of San Lorenzo as a building that possesses orderly beauty due to the "metrical discipline" of its proportions.[25] Wittkower's aesthetic interpretation of proportional ratios in architecture had become widely-accepted in the field of architectural history several years earlier, however, with the publication of his book *Architectural Principles in the Age of Humanism* in 1949; and had been first introduced into the scholarly literature earlier still, with the publication of a future chapter of the book as an article in the *Journal of the Warburg and Courtauld Institutes* in 1945.[26]

Wittkower's blending of proportion-1 and proportion-2 constitutes the basis of his comprehensive theory of medieval and Renaissance architecture, which I call the Wittkower

Paradigm because it is widely-accepted and rarely questioned in the field of architectural history today.[27] Indeed, some scholars have interpreted my previously-published findings pertaining to the proportions of the basilicas of San Lorenzo and Santo Spirito in terms of this paradigm, even when I have specifically noted that my findings contradict it.[28] The present study continues my reexamination of the measurable proportions of these basilicas (proportion-1 and proportion-3) independent of the Wittkower Paradigm. Although challenging the Wittkower Paradigm is not a purpose of this study, such a challenge is nonetheless provided by the extensive contrary evidence that this study brings to light, which the paradigm cannot explain. A brief summary of this paradigm is necessary in order to help the reader recognize it and understand where my findings challenge it. The Wittkower Paradigm has three main characteristics: 1) an aesthetic interpretation of the problem of architectural proportion in architecture, 2) suppression of the physical object of study, and 3) a set of assumptions that I call "Geometry vs. Number."

<u>Aesthetic Interpretation of Architectural Proportions</u>

In his Preface to the 1962 edition of *Architectural Principles*, Wittkower notes that he intended the book primarily to addresses the issue of aesthetics in Renaissance architecture. According to Wittkower, when the book first came out in 1949, "Kenneth Clark wrote in the *Architectural Review* that the first result of this book was 'to dispose, once and for all, of the hedonist, or purely aesthetic, theory of Renaissance architecture,' and this defined my intention in a nutshell."[29] The word "purely" in this passage indicates that Wittkower does not object to *all* aesthetic interpretations of Renaissance architecture, but only those that would interpret it as "art-as-such," independent of any theoretical, social, practical, or other considerations.[30] As the title implies, Wittkower's *Architectural Principles in the Age of Humanism* appears to be a reply to Geoffrey Scott's *The Architecture of Humanism* of 1914, in which Scott declares: "The Renaissance produced no theory of architecture. It produced treatises on architecture…. [Renaissance architects] gave us rules, but not <u>principles</u> [my underline]. They had no need of theory, for they addressed themselves to taste."[31]

For Scott, Renaissance architecture is based on taste rather than theory, and the aesthetic impulse of taste is "…guided, if it is guided at all, by instincts of which the intellect can give no immediate account."[32] Scott furthermore denies that any "exact mathematical sequences," "fixed ratios," or "fixed proportions" can be responsible for architectural beauty.[33] Thus, while Scott recognizes proportion-1, as in the preceding quotations; and proportion-2, as in his references elsewhere to, for example, a scheme of "vast proportions" and an "ill-proportioned" decorative order, he does not recognize proportion-3, or, the possibility that Renaissance architects might have used particular proportional relationships (proportion-1), in sets, for theoretical purposes.[34]

Wittkower's contribution to the study of architectural proportion is his recognition of what I have labeled proportion-3 as a promising topic of scholarly inquiry. Indeed, prior to the publication of *Architectural Principles*, no scholar had ever seriously considered the possibility that sets of proportions (also my term) might contain theoretical content.[35] Wittkower, however, sees no need to separate proportion-3—or, for that matter, proportion-1, which proportion-3 contains—from proportion-2. Thus, he sees no need to separate quantitiative proportions from architectural aesthetics. On the contrary, he bases much of his theory of Renaissance architecture on the assumed unity of all three. Thus he asserts: "I think it is not going too far to regard commensurability of measure [proportion-1] as the nodal point of Renaissance aesthetics [proportion-2]."[36]

That Wittkower's reference to aesthetics in the preceding quotation refers *both* to the aesthetic perceptions of Renaissance architects (any anachronism in his use of the term aesthetics to apply to the Renaissance notwithstanding), *and* to the aesthetic perceptions of Wittkower and his readers, is made clear in his claim that: "Italian architects strove for an easily perceptible ratio between length, height and depth of a building, and Palladio's villas exhibit this quality most lucidly."[37] Thus, according to Wittkower, Renaissance architects "strove"—past tense—to produce a particular aesthetic effect, and their buildings "exhibit"—present tense—this effect to us today. We must not, therefore, make the mistake of interpretting Wittkower's theory of Renaissance architecture as entirely historical. It uses historical analysis as a tool of architectural criticism, in order to explain the orderly appearance of Renaissance architecture today (proportion-2) as a product of particular proportional ratios (proportion-1). Wittkower may speculate about the intentions of Renaissance architects, but he always returns to the aesthetic perceptions of the present-day observer, which are his main concerns, even if such perceptions are subjective, and ultimately Wittkower's own perceptions.

Wittkower initiates another historical discussion for the purpose of explaining his aesthetic interpretation of Renaissance architecture(proportion-2) in terms of quantitative architectural proportions (proportion-1), in his discussion of the façade of the basilica of Santa Maria Novella. In *Architectural Principles* he writes:

> "All the new elements introduced by Alberti in the façade, the columns, the pediment, the attic, and the scrolls, would remain isolated features were it not for that all-pervading harmony which formed the basis and background of his whole theory. Harmony, the essence of beauty, consists, as we have seen, in the relationship of the parts to each other and to the whole, and, <u>in fact</u> [my underline], a single system of

> proportion permeates the façade, and the place and size of every single part and detail is fixed and defined by it. Proportions recommended by Alberti are the simple relations of one to one, one to two, one to three, two to three, three to four, etc., which are the elements of musical harmony and which Alberti found in classical buildings."[38]

In this passage Wittkower presents his description of the façade from Alberti's point-of-view up to the words "in fact." He then shifts to the reader's (and thus his own) point-of-view. In the next sentence he shifts back to Alberti's point-of-view, with a discussion of some of the quantitative proportions that Alberti recommends in *De re aedificatoria*, Book IX. Wittkower continues with a proportional analysis accompanied by his own single-line diagrams of the façade in question, quantitatively describing proportional ratios that he believes to be present in the façade, by noting: "…the whole building is related to its main parts in the proportions of one to two, which is in musical terms an octave."[39] He bases these descriptions, however, neither on measurements nor on documentary evidence of Alberti's intended proportions, but rather, on his own aesthetic interpretations. Wittkower's absolute confidence in the correctness of these interpretations, such that he accords them the reliability of quantitative, factual evidence—he even uses the word "fact" in the preceding passage to describe his aesthetic interpretation of Alberti's façade—helps to explain his consistent suppression of the object in his studies of architectural proportion, which is the second characteristic of the Wittkower Paradigm.

Suppression of the Object

Wittkower's confidence in his ability to describe aesthetically-pleasing proportions (proportion-2) in the quantiative terms of proportion-1, and to supplement these descriptions with documents that he believes supports them by providing evidence of Renaissance ways of thinking that are consistent with them, leads him to suppress the object—i.e., the building under consideration—in favor of the ideas that he believes the object represents. He sees no need to confirm his aesthetic interpretations through direct observation of the object, such as measurement. Thus in the preceding example, Wittkower makes the aesthetic judgement that Alberti's Santa Maria Novella façade appears orderly, finds in *De re aedificatoria* evidence that Alberti was interested in simple whole number ratios; and then, based on these aesthetic and documentary observations, concludes that "in fact" Alberti used such proportions in the design of this façade.

That Wittkower is not opposed to measurement as a research method, however, but simply finds it to be unnecessary, is indicated by his footnote to his later comment in *Architectural*

Principles: "…Palladio's conception of architecture, as indeed that of all Renaissance architects, is based on commensurability of ratios." The footnote reads: "The time for a reliable survey of Renaissance buildings has not yet come, but I feel confident that it would confirm my assumption."[40]

In his 1953 discussion of the aesthetic proportions (proportion-2) of the basilicas of San Lorenzo and Santo Spirito, Wittkower uses an overtly psychological tactic to suppress the object. After making the aesthetic observation that when the basilica of San Lorenzo is viewed down the length of the nave it appears "metrical" (i.e., orderly), and conveys a visual impression similar to that of an early Renaissance perspective panel, he refers to documentary evidence that Brunelleschi invented scientific perspective drawing. Then, based on these aesthetic and documentary observations, he asks his readers to meditate upon the orderly appearances of both of Brunelleschi's basilicas, while trying to imagine that Renaissance people saw these buildings in the perspectival manner that he proposes. He writes:

> "We all know that the way we see visual images depends on the notions in which we believe. Brunelleschi's invention of linear perspective set the seal to the Renaissance conviction that the observing eye perceives metrical order and harmony throughout space. If one is keyed up to the metrical discipline of buildings like S. Lorenzo or S. Spirito and tries to see as if through a screen the lines retreating towards the vanishing point and the quickening rhythm of the tranversals, it is possible to evoke visual reactions similar to those which Renaissance people must have experienced."[41]

When in this passage Wittkower encourages his readers to become "keyed up to the metrical discipline" of Brunelleschi's basilicas, he is not encouraging them to measure the buildings in order to understand the actual metrical characteristics of the objects. On the contrary, the objects are far from his concern in this presentation of an abstract theory of Brunelleschi's assumed aesthetic intentions. He writes "metrical discipline," which implies proportion-1, but he clearly means orderly beauty, which is proportion-2. He thus suppresses the object (the bearer of proportion-1), in order to avoid what he considers to be the distraction of unecessary measurements. He considers measurements to be unecessary due to his belief that the subject of his study, the orderly beauty of the basilica (proportion-2) is a product of mathematical ratios (proportion-1), and that a causal relationship between the two is plainly visible and therefore factually certain without measurements.

According to the Wittkower Paradigm, even documentary evidence that pertains directly to the physical characteristics of the object can be suppressed when it conflicts with a preferred aesthetic interpretation. A critical element in Wittkower's "metrical" interpretation of the basilica of

San Lorenzo, for example, is the dark, *pietra serena* grid pattern in the pavement, which includes a dark line running down the middle of the nave (Figure 1-1). According to Wittkower, this "…dark line of the central axis invites the visitor to move along it so that both walls of the nave seem to diminish equally towards the vanishing point." In a footnote to this statement Wittkower notes: "The present floor dates from 1886, but the design, no doubt, repeats the original one."[42] In fact, no evidence of the original pavement pattern has come to light, but an interior view of 1671 by Giovanni Baptista Falda shows a different pavement design with no central stripe (Figure 1-2).[43] Whether this design is the original one or Falda's invention is unknown, but its lack of correspondence with the present design at least raises doubt about the originality of the latter. Despite the lack of evidence pertaining to the original pavement, Wittkower suppresses the nineteenth-century identity of the present pavement and substitutes it with an assumed fifteenth-century design intention. He does so based on his belief that his aesthetic interpretation of the building, which he supports by citing documentary evidence of Brunelleschi's interest in perspective, provides more reliable evidence about the original pavement design than any potentially contrary physical evidence provided by the object (such as a post-fifteenth century date of manufacture), even if that contrary physical evidence is supported by documentary evidence.[44]

Once one believes that one's aesthetic judgements of proportion-2 can be accurately described in the quantitative terms of proportion-1, but a small intellectual step is required to believe that one's perceived aesthetic distinctions between architectural styles can be described in quantitative terms as well. Thus, if one believes that some buildings contain orderly beauty (proportion-2) because of particular proportional relationships in their dimensions (proportion-1), one might be inclined to believe that some buildings look Gothic and others Renaissance because of differences in the kinds of proportional relationships contained in their dimensions.[45] Furthermore, if "commensurability of measure" can be the "nodal point of Renaissance aesthetics," as Wittkower claims (see above), then perhaps *incommensurability* of measure can be the nodal point of *medieval* aesthetics. Such hypothetical reasoning provides a possible explanation for the third characteristic of the Wittkower Paradigm, the theory of "Geometry vs. Number."

Geometry vs. Number

Wittkower began revealing the principles of the Geometry vs. Number theory as a component of the Wittkower Paradigm in 1945, with the publication of his aforementioned article "Principles of Palladio's Architecture—II" in the *Journal of the Warburg and Courtauld Institutes*.[46] In this article he first presents his theory of a Palladian, and thus Renaissance, system of architecture based on whole number ratios. In his 1949 revision of this article for inclusion in *Architectural Principles*, he makes an incongruous yet revealing digression from his discussion of Palladio and music theory: he inserts a brief analysis of a drawing by Sebastiano Serlio that depicts a classical, pedimented door frame inscribed within a large square. The square, he notes, is crisscrossed by regulating lines that intersect the corners of the frame (Figure 1-3). Serlio thus appears to present a geometrical method for generating the proportions of the frame. Not so, Wittkower continues however, for Serlio's intentions, he claims, were in fact numerical and harmonic. He writes: "Serlio does not mention explicitly that the opening thus constructed is related to the width of the bay as 1:3 and to the height of the square as 2:3. Thus we are back to ratios of small integral numbers with their musical connotations."[47] The possibility that a Renaissance architect might have determined architectural proportions using geometry rather than number evidently caused Wittkower considerable discomfort, so in this passage he simply interprets Serlio's geometrically-derived door frame proportions as numerical.

In the third edition of *Architectural Principles*, published in 1962, Wittkower further reveals this discomfort in his complicated elaboration of this numerical interpretation of Serlio's geometrical door frame proportions. In the revised passage Wittkower admits that Serlio's drawing "...seems to suggest a geometrical procedure, not very different from the 'ad quadratum' method practiced during the later Middle Ages."[48] There is a difference, Wittkower claims however, between medieval geometry and Serlio's method, for "...in Serlio's case, the geometrical scheme is posterior rather than prior to the ratios chosen for the door. His design was evidently the result of commensurable divisions of the large square." The proportions of the door are all whole number ratios, Wittkower continues, such as 1:3 and 2:3, and thus "'mediaeval' geometry here is no more than a veneer that enables practitioners to achieve commensurable ratios without much ado."[49]

Wittkower must have considered Serlio's geometrical door frame construction to be a highly visible potential contradiction to his numerical interpretation of Renaissance architectural aesthetics to have devoted so much intellectual energy to keeping "'mediaeval' geometry" and Renaissance number separated. A Renaissance architect such as Serlio, according to the Geometry vs. Number theory within the Wittkower Paradigm, could not have used geometry in any important way to establish architectural proportions; and if any evidence, such as Serlio's door construction, appears to indicate that he did, then some explanation for it must, and inevitably can, be found within the limits of the paradigm.

In his article "Systems of Proportion," published in the *Architect's Yearbook* in 1953, Wittkower articulates the Geometry vs. Number theory more comprehensively. There he summarizes the theory in three non-consecutive paragraphs. In the first, Wittkower establishes the basic premise of Geometry vs. Number:

> "It has, I hope, become evident that two different classes of proportion, both derived from the Pythagoreo-Platonic world of ideas, were used during the long history of European art, and that the Middle Ages favored Pythagoreo-Platonic geometry, while the Renaissance and classical periods preferred the numerical, i.e., the arithmetical side of that tradition."[50]

In the second paragraph, he elaborates on the Renaissance side of this two-sided theory—the side that claims that the Renaissance favored the use of whole numbers rather than irrational proportions generated by geometry, and that such use expressed the spirit of the age:

> "It seems almost self-evident that irrational proportions would have confronted Renaissance artists with a perplexing dilemma, for the Renaissance attitude to proportion was determined by a new organic approach to nature, which involved the empirical procedure of measuring, and was aimed at demonstrating that everything was related to everything by number. I think it is not going too far to regard commensurability of measure as the nodal point of Renaissance aesthetics."[51]

He devotes the third paragraph to the medieval side of the theory, which claims that the medieval period favored the use of geometry in art and architecture, rather than number, and that such usage also expressed the spirit of the age:

> "While to the organic, metrical Renaissance view of the world rational measure was a *sine qua non*, for the logical, predominantly Aristotelian medieval approach to the world the problem of metrical measure hardly arose. And although the Pythagoreo-Platonic concept of the numerical ratios of the musical scale never disappeared from mediaeval theological, philosophical, and aesthetic thought, there was no over-riding urge to apply them to art and architecture. On the contrary: the mediaeval quest for ultimate truth behind appearances was perfectly answered by geometrical configurations of a decisively fundamental nature; that is, by geometrical forms which were irreconcilable with the organic structure of figure and building.[52]

Wittkower subsequently republished variations of these three broadly-worded paragraphs, with little or no elaboration, several times throughout his career.[53] These far-reaching statements have received little scholarly challenge to date.[54] The resilience of the theory of Geometry vs. Number may owe in part to its lack of specificity, a characteristic that Wittkower enhances by allowing five exceptions to it:

Exception #1: Flexible Historical Interpretation of Geometry and Number

According to Wittkower's first and most general exception to the Geometry vs. Arithmetic component of the Wittkower Paradigm, examples of whole number proportions in medieval architecture, and of geometrical proportions in Renaissance architecture, are acknowledged to exist but are not considered to be historically significant because number, according to Wittkower, was not as important to the medieval period as it was to the Renaissance, and geometry was not as important to the Renaissance as it was to the medieval period. Wittkower writes:

> "Of course, metrical proportions were used during the Middle Ages—indeed no building is possible without them—and geometry played a considerable part in Renaissance aesthetics and Renaissance thought. I have only to remind the reader of the importance attached to the circle. On the other hand, it must be asked whether the same numerical and geometrical proportions also had the same meaning in the Middle Ages and the Renaissance. The answer seems to be in the negative."[55]

Exception #2: The Circle and the Square

The second exception is a subsidiary of the first, but deserves separate consideration due to the importance of both the circle and the square in the architecture of both the medieval and Renaissance periods. To Wittkower's reference to the circle in the preceding quotation we may add his comments regarding the capability of the square to have either a medieval or Renaissance identity, depending on the interpretations of the original users:

> "The medieval 'just measure' with its setting of one square into another was discarded by Renaissance artists, no doubt, because of the incommensurability of this configuration. But it was during the Renaissance that artists became aware of the simple numerical ratios of the sides of a square, and in the ratio 1:1 (unison in music) a Renaissance mind found beauty and perfect harmony. Thus it appears that such a simple geometrical figure as the square can be used in a metrical and rational as well as in a geometrical but irrational context, and can elicit completely different reactions."[56]

Thus, Wittkower claims here, just as Serlio drew geometrical figures to explain his contruction of a classical door surround, as noted above, but in fact—according to Wittkower—meant to communicate not geometrical relationships but numerical harmonic ones; whenever Renaissance architects used the square, they intended to express not a geometrical figure but the numerical harmonic ratio of 1:1, or, a unison. I describe the preceding passage as a claim rather than an argument because it is not supported by evidence.

Exception #3: The Ratio 1:√2

According to Wittkower, the ratio 1:√2 "…is the only irrational number widely propagated in the Renaissance theory of architectural proportion."[57] Since the ratio 1:√2 is by far the most commonly-mentioned irrational ratio in the scholarly literature pertaining to medieval architectural proportions, this exception is very significant indeed, especially since Wittkower addresses neither the contradiction between it and the second sentence that follows it in *Architectural Principles*: "It is probably right to say that rarely did Palladio or any other Renaissance architect use irrational proportions in practice…"; nor between it and his above-quoted claim that "…irrational proportions would have confronted Renaissance artists with a perplexing dilemma."[58]

Exception #4: *Quattrocento* Transition

Wittkower excludes the entire fifteenth century, or approximately half of the Renaissance, from his theory of Geometry vs. Number by interpreting this century as a "transition" during which mixtures of medieval geometry and Renaissance number might be found. He writes:

> "To be sure, nobody in his senses will deny that mediaeval geometrical concepts survived and were still being used in the Quattrocento. Nevertheless such a statement should not obscure a recognition of the new and characteristic pattern of the Renaissance position. It is even possible to point out precise moments of transition from a primarily geometrical to an arithmetical approach to proportion."[59]

Exception #5: Medieval Survivals

Finally, Wittkower allows the possiblity that some Renaissance architects might "still" have been aware of "medieval conceptions of proportion," and might have used them on occasion, as in the following statement pertaining to sixteenth-century plans for the continuation of construction of the basilica of San Petronio in Bologna:

> "In 1592 an architect who was still aware of medieval conceptions of proportion published an engraving in protest against the proposed reduction of height. He suggests that by abandoning the medieval triangulation the church would lose proportion and coherence."[60]

Thus, according to this exception, knowledge of triangular proportions could not have constituted Renaissance knowledge, even if it reached the Renaissance from the medieval period through the continuity of cultural transmission. Rather, such knowledge could only constitute an exception to normal, number-oriented, Renaissance knowledge.

<u>The Present Study vs. The Wittkower Paradigm</u>

Readers will have to evaluate for themselves how many exceptions Wittkower's theory of Geometry vs. Number can accommodate before the exceptions invalidate it. The present study is inadvertently based on the inverse of the three-part Wittkower Paradigm, which we have seen consists of: 1) an aesthetic interpretation of the problem of proportion, 2) suppression of the object, and 3) "Geometry vs. Number"; for the present study is characterized by <u>the following three assumptions and methods</u>: 1) sets of architectural proportions are interpreted as rhetorical devices that have no influence on anyone's aesthetic appreciation of architecture, 2) all hypotheses are based on evidence derived from direct observation of the object, and 3) geometry and number are assumed to have been complementary and equally-important tools of architectural design throughout both the medieval and Renaissance periods.

In summary, Wittkower's framework for the study of medieval and Renaissance architecture is based on an aesthetic interpretation of architectural proportion that assumes that orderly beauty (proportion-2) has quantitative causes (proportion-1). The present study removes aesthetic considerations from the study of architectural proportions as mathematical constructs (proportion-1), and reframes the subject as a study of rhetorical structures composed of sets of proportions (proportion-3) that are incorporated into architectural dimensions to communicate non-visual iconographical content.

In this study I avoid aesthetic considerations of architectural proportions by maintaining a strict separation between proportion-1 and proportion-2, and by assuming that these two types of proportion can have no significant influence on each other. I do so based on <u>the following two</u>

contentions: 1) aesthetic interpretations of quantatitive architectural proportions are inherently illogical (see Epilogue), and 2) such interpretations constitute unproductive distractions from the study of architectural proportion as an historical problem. I expect that most readers will not readily accept either of these contentions. I simply ask those readers to set aside temporarily all aesthetic considerations of proportion (proportion-2) in order to test the new approach to the study of architectural proportion (proportion-1 and proportion-3) that I present in this study.

1.3 Summary of Chapters

In preparation for the historical investigations of the basilicas of San Lorenzo and Santo Spirito presented in the main body of this study, this introduction (Chapter 1) examines longstanding scholarly preconceptions pertaining to the first of these buildings, and their likely causes. It demonstrates that the persistent scholarly association of the orderly appearance of the basilica of San Lorenzo with the subject of architectural proportion stretches back over two centuries, and appears to be rooted in the inherent ambiguity contained within both the word and concept of proportion. Since the eighteenth century, this introduction argues, most architectural historians have associated proportion *simultaneously* with mathematical (or geometrical) relationships *and* architectural beauty. This conflation has led architectural historians to treat architectural proportion as an aesthetic problem rather than an historical one; and thus, to treat it as a mode of speculation about the causes of early Renaissance architectural beauty as perceived by historians, rather than as a cultural product of the fifteenth-century that can illuminate the intentions of early Renaissance architects and patrons.

In order to remove aesthetics from any discussion of proportion as an historical problem, this introduction establishes definitions that distinguish between proportion as a description of architectural beauty, and proportion as a mathematical (or geometrical) relationship. It then builds upon the latter definition by proposing that late medieval and early Renaissance architects created "sets of proportions," embedded in the dimensions and quantities of architecture, to communicate non-visual, iconographical content. Thus, the present study reframes the subject of architectural proportion as part of the rhetorical rather than aesthetic structure of architecture.

This reframing represents a radical departure from the customary view of architectural proportion as a primary contributor to Renaissance aesthetics. Indeed, this customary view is so firmly established among scholars today that it may be considered a paradigm—I call it the Wittkower paradigm in acknowledgment of Rudolf Wittkower's singular role in promoting it in his various publications of the 1940s and 1950s. Since most scholars will likely be inclined to interpret the findings of this study in terms of the Wittkower Paradigm, and since I argue that such an interpretation would be fundamentally incorrect, in this introduction I provide a brief critical summary of this paradigm, identifying three main characteristics of it: 1) an aesthetic interpretation of architectural proportion, 2) suppression of the object of study, and 3) the theory that I call "Geometry vs. Number." Readers will thus be able to recognize this paradigm as a distinct theoretical framework that need not be accepted as a given.

Chapter 2 turns to the basilica of San Lorenzo and begins with a metrical analysis of a single bay of the nave arcades. This analysis is based on an original survey, conducted by the author from mobile scaffolding erected in the basilica by the Italian government for this purpose. This metrical analysis forms the basis of a new methodology that combines observation-based and documentary sources in order to identify intentional proportions and distinguish them from coincidental ones. It then applies this new methodology to reveal three overlapping sets of proportions in the San Lorenzo nave arcade bays, each exhibiting the architect's mastery of geometry, number theory and arithmetic, respectively. The scope of this chapter expands when necessary to include the arcade bays of the basilica of Santo Spirito, and broad historical themes pertaining to late medieval geometry, number, arithmetic, and systems of measurement, all for the purpose of illuminating the intentional sets of proportions in the San Lorenzo nave arcade bays. Although I have measured and analyzed the basilica of Santo Spirito as comprehensively as the basilica of San Lorenzo, and although the former provides crucial evidence in support of the findings of this study, the majority of this study is devoted to the basilica of San Lorenzo because it is by far the more historically complex and important of the two basilicas.

Chapter 3 applies the methods and concepts developed in Chapter 2 to the problem of understanding the proportions (proportion-1 and proportion-3) of the overall basilica, including the Old Sacristy. This chapter proposes a logical, step-by-step reconstruction of the basilica floor plan, and many of the vertical sets of proportions as well, based on successive subdivisions of a two-square rectangle. This procedure reproduces many of the obscure and seemingly irregular measurements found in the basilica today, and thus suggests that the logic of proportion can serve not only as a subject of architectural history research, but also as a tool with which to study it—provided that that logic can be demonstrated to be the result of the architect's intentions, rather than coincidence. This chapter concludes by identifying a seemingly anomalous feature of the iconographical program of this basilica—a feature unrelated to Saint Lawrence or any common Medici themes as might be expected—and interprets it as a possible effort by the builders to use number symbolism to explain a prominent feature of the basilica that appears to have been generated unintentionally by the design process that I have reconstructed.

The notion, developed in Chapter 3, that certain sets of proportions can be considered genuine historical artifacts, and thus can be used as tools to explore an architect's intentions, is pursued further in Chapter 4. Here documents rather than measurements are the main focus of analysis, but the proportional findings from Chapters 2 and 3 nevertheless serve as critical new tools to help resolve several persistent questions pertaining to the construction history of the basilica of San Lorenzo. Progress in resolving the questions of 1) who designed the spatial conception and sets of proportions throughout the basilica, 2) who designed and supervised the manufacture of the sculptural details of the nave arcades, 3) what were the exact location and configuration of the old basilica of San Lorenzo in relation to the new one, and 4) what was the precise sequence of the various stages of construction of the basilica, receive particular impetus from these new proportional findings. This chapter culminates in a step-by-step reconstruction of the above-noted stages of construction. This reconstruction may be considered a continuation of the one offered in Chapter 2, carrying forward the proposed design process from the detailed design through the various stages of execution on the site.

Chapter 5 explores yet further the potential value of the study of sets of architectural proportions (proportion-3) in advancing architectural history by using the proportional findings from Chapters 2 and 3 to help identify two likely medieval precedents for various design features of the basilicas of San Lorenzo and Santo Spirito. The apparent influence of one these earlier works, the basilica of Santa Maria del Carmine in Pavia, on the Florentine basilicas in question, and on other works in Florence, calls attention to Lombardy as a region of vibrant proto-Renaissance creativity and Roman revivalism that is worthy of increased scholarly attention.

This study concludes in Chapter 6 by using the weight of the findings presented in the preceding chapters to propose an alternative to the Wittkower Paradigm, since this paradigm is unable to explain these findings. Chapter 6 proposes 1) the notion of “simultaneity” instead of Wittkower’s separation of medieval geometry and Renaissance number; 2) a rhetorical interpretation of sets of proportions as used in the history of architecture, instead of Wittkower’s aesthetic interpretation; and 3) a methodology that blends observation-based and documentary sources instead of Wittkower’s almost exclusively document-based approach.

1.4 Previously Published and New Sections

This study incorporates and elaborates upon several articles that I have published within the past four years. The analysis of the San Lorenzo nave arcade set of proportions in Chapter 2 is based on my articles: “Ugly Little Angels: Deliberately Uneven Construction Quality in the Basilica of San Lorenzo in Florence,” published in *arq: Architectural Research* in 2007; and “How Much Brunelleschi? A Late Medieval Proportional System in the Basilica of San Lorenzo in Florence,” published in the *Journal of the Society of Architectural Historians* in 2008.[61] Most of the online appendices to the latter have been substantially reworked and incorporated throughout the present study, while the postscript to that article, “A Disciplinary Triad,” now forms part of Chapter 6. “Ugly Little Angels Revisited,” which appeared as a book chapter in *Quality Out of Control: Standards for Measuring Architecture* (eds. Allison Dutoit, Juliet Odgers, and Adam Sharr) in 2010, has been substantially reworked and incorporated into Chapter 4.[62] My articles “The Lombard Connection: Northern Influences in the Basilicas of San Lorenzo and Santo Spirito in Florence,” which appeared in *Annali di Architettura* in 2009; and “Quantification and the Medieval Mind: An Imperfect Proportional System in the Basilica of Santa Maria del Fiore in Florence,” which appeared in *Some degree of happiness, Studi di storia dell'architettura in onore di Howard Burns* in 2010, have been incorporated into Chapters 5 and 6.[63] I developed some of the definitions of terms presented in Chapter 1 in the prepration of the international conference “Proportional Systems in the History of Architecture,” hosted by Leiden University, 17-19 March 2011, which I organized in collaboration with Caroline van Eck and Eeclo Nagelsmit. In order to maintain the internal consistency of each chapter, many of which were conceived as separate articles, I have let stand occasional redundancies, such as repetitions of quotations or documentary references.

The present electronic version of this dissertation contains a correction to Figure 2-37 and various minor corrections to the text with respect to the two-volume printed version.

[1] Francesco Colonna, *Hypnerotomachia Poliphili: Venice 1499* (New York and London: Garland Publishing, Inc., 1976), c (verso); In the following translation by Godwin, I have changed Godwin's "door" to "portal." "...Being inclined to study, and inflamed with desire to understand the fertile intellect and the sharp awareness of him who had been the perceptive architect of its proportions, being interested in both its underlying geometrical scheme and its organizing lines, analysing it carefully, I did as follows: I precisely measured the square form under the coupled columns either side of the portal. From this measurement I readily grasped the system of proportions of the aforesaid portal, which I will briefly explain." Francesco Colonna, *Hypnerotomachia Poliphili: The Strife of Love in a Dream*, ed. and transl. Joscelyn Godwin (London: Thames & Hudson, 1999), 44.

[2] "Outre la beauté du plan on y admire la belle proportion des colonnes, la pureté des profils & des entablemens." Quatremère de Quincy, "Brunelleschi (Philippe)" in *Encyclopédie Méthodique*, vol. 1: "Architecture" (Paris: Panchoucke, 1788), 341.

[3] William Henry Goodyear, *Renaissance and Modern Art* (New York: Flood & Vincent, 1894 [printed in 1900]), 76.

[4] The complete passage is: "Ma questa sorta di regolarità geometrica, questo bisogno di ripetere il motivo fondamentale con insistenza che può apparire gotica, è per noi rivelatore di una necessità di ritmo, e il predominio dei vuoti, la pacata bicromia sono indici di una suprema eleganza del tutto toscana." Emilio Lavagnino, *Brunellesco* (Rome: Istituto Nazionale "L.U.C.E.," 1931), 8.

[5] In this study I use the term "aesthetic" to refer to the appreciation or criticism of the beautiful, with acknowledgment of the eighteenth and nineteenth-century origins of this concept. "Aesthetic," *Oxford English Dictionary Online*, 2nd ed., 1989, <http://www.oed.com/view/Entry/3237?redirectedFrom=aesthetic#eid> (30 June 2011, access limited to subscribers).

[6] Rudolf Wittkower, "Brunelleschi and 'Proportion in Perspective,'" *Journal of the Warburg and Courtauld Institutes* 16 (1953), 275-291 (for "metrical discipline" and other uses of the term "metrical": 289). Ackerman writes that this article "…had a great influence on the way my generation has thought about early Renaissance architecture." James S. Ackerman, "Rudolf Wittkower's Influence on the History of Architecture," *Source: Notes in the History of Art* 8-9 (1989), 88.

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[7] Sumner McK. Crosby, ed., *Helen Gardner's Art Through the Ages*, 4th ed. (London: G. Bell and Sons, 1959), 301. Gardner does not mention the basilica of San Lorenzo in the first three editions of this textbook, which were written entirely under her authorship. In the first edition she uses proportion in the qualitative sense in a description of the church of Sant' Andrea in Mantua: "Here one feels that the artist was not dominated by religious emotion, as was the builder of the Gothic cathedral, but by a desire for quiet, harmonious design based upon orderliness and proportion." Helen Gardner, *Art Through the Ages: An Introduction to its History and Significance* (New York: Harcourt, Brace & Company, 1926), 238. In the second and third editions, she makes aesthetic observations that imply the idea of proportion in the qualitative sense, noting that the Pazzi Chapel, San Francesco in Rimini and Sant' Andrea in Mantua exhibit "…the classical balance of vertical and horizontal…." Idem, *Art Through the Ages: An Introduction to its History and Significance* (New York: Harcourt, Brace & Company, 1936), 345; and Idem, *Art Through the Ages*. 3d ed. (New York: Harcourt, Brace & Company, 1948), 438.

[8] H.W. Janson, *History of Art: A Survey of the Major Visual Arts from the Dawn of History to the Present Day* (New York: Harry N. Abrahms, Inc., 1962), 320.

[9] Patrick Nuttgens, *The Pocket Guide to Architecture* (New York: Simon and Schuster, 1980), 115.

[10] Marvin Trachtenberg and Isabelle Hyman, *Architecture, from prehistory to post-modernism: the Western Tradition* (New York: H.N. Abrams, 1986), 286. Although this comment does not appear in the second edition, the authors' similar aesthetic assessment of the Ospedale degli Innocenti expressed in quantative terminology, attributing "…its discernible *all'antica* resonance…" in part to the "…science behind its proportions…," appears in both editions. Note that "science" is a term that implies a foundation in quantitative data. *Ibid*., 284; and Idem, *Architecture: From Prehistory to Postmodernity*, 2d ed. (Upper Saddle River, New Jersey: Prentice Hall, Inc., 2002), 280.

[11] Saalman rather ambiguously seems to suggest that Brunelleschi's "…decision to make the main space of the sacristy [i.e., the Old Sacristy] a square…" was a matter of "…personal artistic expression…." Howard Saalman, *Filippo Brunelleschi: The Buildings* (University Park, Pennsylvania: Pennsylvania State University Press, 1993), 141. For Saalman's other remarks about the proportions of the basilica of San Lorenzo, including the Old Sacristy, see: *Ibid*., 208-209, 350, 361-362, and 431.

[12] In my word choice here I am influenced by Geoffrey Scott: "The attempt has constantly been made to discover exact mathematical sequences in beautiful buildings as though their presence were likely either to cause beauty or explain it." Geoffrey Scott, *The Architecture of Humanism* (New York and London: W.W. Norton & Company, 1974 [1914]), 155.

[13] Wittkower often states that his aesthetic interpretations correspond to Brunelleschi's intentions (and thus, that the historian's aesthetic interpretations are the same as were the subjects'), but provides no evidence to justify these claims, as in the passages: "…it would almost appear a historical necessity that he, the genuius who brought about single-handed the new metrical architecture of the Renaissance, should have regarded harmony and proportion in the elevations of his buildings and their changing perspective views as a single problem…"; "granted that Brunelleschi wanted his buildings to be looked at as if they were projected on to an intersection, the difference between architecture and painting becomes one of artistic medium rather than of kind;" and "I venture to say that Brunelleschi would have liked seeing his buildings in photographs." Wittkower, "Brunelleschi and 'Proportion in Perspective,'" 276 and 289-290. In a similarly unsupported narration of Brunelleschi's intentions expressed in a tone of certainty, Janson claims: "…the secret of good architecture, Brunelleschi was convinced, lay in giving the 'right' proportions—that is, proportional ratios expressed in simple whole numbers—to all the significant measurements of a building." Janson, *History of Art*, 320.

[14] Scott, *The Architecture of Humanism*, 155. For a similar distinction between these two definitions of the word proportion in French see Claude Perrault, *Ordonnance des cinq espèces de colonnes selon la méthode des anciens* (Paris: Jean Baptiste Coignard, 1683), vi-vii.

[15] Prior to the publication of my surveys and proportional analysis of the basilica of San Lorenzo, no one had ever studied the proportions of this building based on accurate and comprehensive measurements. Matthew A. Cohen, "How Much Brunelleschi? A Late Medieval Proportional System in the Basilica of San Lorenzo in Florence," *Journal of the Society of Architectural Historians* 67 (2008), 18-57.

[16] Tom Wolfe memorably critiques the bland monotony of Avenue of the Americas in New York City as "Row after row of Mies van der row of glass boxes." Tom Wolfe, *Bauhaus to Our House* (London: John Cape Ltd., 1982), 4.

[17] In light of this discussion, Janson's above-quoted claim that "...proportional ratios expressed in simple whole numbers" influence the appearance of the basilica of San Lorenzo can be seen to be illogical because such ratios, which my survey indicates are not present in this basilica in any case, could never have such an influence even if they were present. See note 8 above.

[18] Older definitions of proportion found in the architectural literature, such as those of Vitruvius, Sylvio Belli, Andrea Palladio, and Daniele Barbaro, are not relevant to this discussion because they do not reflect modern English usage. Vitruvius, *The Ten Books on Architecture*, trans. Morris Hicky Morgan (New York: Dover Publications, Inc., 1960 [1914]) III.1.i, p. 72; and James S. Ackerman, *Palladio* (London: Penguin Books, 1966), 161.

[19] Sébastien Le Clerc, *A Treatise of Architecture, with remarks and observations necessary for young people, who wou'd apply themselves to that noble art*, trans. Ephraim Chambers (London : Printed and sold by W. Taylor, W. and J. Innys, J. Senex, and J. Osborne, 1723), vol. 1, p. 29; "Par proportion, on n'entend pas ici un rapport de raisons à la manière des geomètres; mais une convenance de parties, fondée sur le bon goût de l'architecte." Sébastien Le Clerc, *Traité d'architecture, avec des remarques et des observations trés utiles pour les jeuns gens qui veulent s'appliquer à ce bel art* (Paris: P. Giffart, 1714), 39. Cf. *The Oxford English Dictionary* 12, 2d ed. (Oxford: Clarendon Press, 1989), 647; and Hanno-Walter Kruft, *A History of Architectural Theory: from Vitruvius to the Present* (London: Zwemmer, 1994), 142.

[20] For the distinctions between numerical and arithmetical relationships, see note 22, below.

[21] I have already used this term in my previous publications "How Much Brunelleschi? A Late Medieval Proportional System in the Basilica of San Lorenzo in Florence" (see note 15, above); and "Quantification and the Medieval Mind.": An Imperfect Proportional System in the Basilica of Santa Maria del Fiore in Florence," in M. Beltramini and C. Elam, eds. *Some degree of happiness, Studi di storia dell'architettura in onore di Howard Burns* (Pisa: Edizioni della Normale, 2010), 1-30; as well as in the title and statement of purpose for the conference "Proportional Systems in the History of Architecture," co-organized with Caroline van Eck and Eelco Nagelsmit at Leiden University, 17-19 March 2011.

[22] The difference between numerical and arithmetical correspondences in this definition is a matter of interpretation. For the purposes of this definition I will consider numerical correspondences to be those that highlight certain numerical qualities of integers, such as number progressions, and arithmetical correspondences to be those that highlight particular relationships between numbers that can only be revealed through simple calculation, such as whole-number approximations of the ratio $1{:}\sqrt{2}$.

[23] The simultaneity in sets of proportions under consideration here, which refers to the designs of medieval and Renaissance architects, should not be confused with the above-noted simultaneity of qualitative and quantitative meanings associated with the English word proportion today.

[24] Leonis Baptiste Alberti, *De re aedificatoria* (Florence, 1485), IX, v-vi.

[25] Wittkower, "Brunelleschi and 'Proportion in Perspective,'" 289.

[26] Rudolf Wittkower, *Architectural Principles in the Age of Humanism* (London: The Warburg Institute, 1949); and Idem, "Principles of Palladio's Architecture-II," *Journal of the Warburg and Courtauld Institutes* 8 (1945), 68-106.

[27] My use of the term "Wittkower Paradigm" is independent of Payne's reference to "Wittkower's paradigm," a term that Payne does not define. Alina A. Payne, "Rudolf Wittkower and Architectural

Principles in the Age of Modernism," *Journal of the Society of Architectural Historians* 53 (1994), 332.

[28] In a response to my article "How Much Brunelleschi?," for example, Herzner misrepresents my analysis of the sets of proportions in the basilicas of San Lorenzo and Santo Spirito in terms of the "Geometry vs. Number" characteristic of the Wittkower Paradigm (see below), even though in the introduction I note that my article "…forgoes common preconceptions such as Wittkower's medieval geometry vs. Renaissance arithmetic paradigm…." Cohen, "How Much Brunelleschi?," 18. Herzner writes: "Da dieses Proportionssystem mit seinen irrationalen Zahlen sich jedoch grundlegend von demjenigen unterscheidet, das Brunelleschi in Sto. Spirito angewandt hat, wo die auf ganzen Zahlen beruhenden Proportionen der Renaissanceästhetik entsprechen, stellt sich Cohen im Hinblick auf die Autorschaft von San Lorenzo unvermeidlicherweise die Frage 'how much Brunelleschi?,' die schon im Titel seiner Untersuchung die größtmögliche Aufmerksamkeit sicherstellt." Volker Herzner, "'How much Brunelleschi?' Matthew Cohen und sein Phantom-Architekt von San Lorenzo in Florenz," *Kunstgeschichte*: *Texte zur Diskussion*, 2009-26, < http://www.kunstgeschichte-ejournal.net/discussion/2009/herzner > (21 April 2009). Several other scholars, in conversation with me, have expressed similar Wittkower Paradigm-inflected interpretations of my San Lorenzo and Santo Spirito findings.

[29] Wittkower, *Architectural Principles*, 2d. ed. (1962), Preface, n.p. In the third edition "defined" was changed to "defines." Idem, *Architectural Principles*, 3d. ed. (1971), Introduction, n.p.; and Kenneth Clark, "Humanism and Architecture," *Architectural Review* 109 (1951), 65. Payne similarly describes *Architectural Principles* as: "…the only available (and unchallenged) comprehensive study of Renaissance architectural aesthetics…." Payne, "Rudolf Wittkower and Architectural Principles," 324.

[30] For an overview of the notion of "art-as-such," see M.H. Abrams, "Art-as-Such: The Sociology of Modern Aesthetics." *Bulletin of the American Academy of Arts and Sciences* 38 (1985): 8-33.

[31] Scott, *The Architecture of Humanism,* 40.

[32] *Ibid.,* 37.

[33] *Ibid.,* 170, and cf. 155.

[34] *Ibid.,* 49, 92; and cf. 62, 84, 86. For examples of late medieval sets of proportions, which will be discussed in detail below, see Figures 4-12 and 5-19.

[35] The question of whether Wittkower's studies of sets of proportions (proportion-3) are correct however—for example, whether Renaissance architects used harmonic ratios to the extent and in the ways that Wittkower claims—requires additional analysis. For two explorations of this question, see Deborah Howard and Malcolm Longair, "Harmonic Proportion and Palladio's Quattro Libri," *Journal*

of the Society of Architectural Historians 41, (1982), 116-143; and George Hersey and Richard Freedman, *Possible Palladian villas: (plus a few instructively impossible ones)* (Cambridge, Massachusetts: MIT Press, 1992).

[36] Rudolf Wittkower, "Systems of Proportion," *Architect's Yearbook* 5 (1953), 16. Wittkower provides a similarly explicit statement of the aesthetic basis of his theory of Renaissance architecture in his article on the basilica of San Lorenzo published four years later. In it he argues that the regularity of this basilica, which he claims is related to Brunelleschi's knowledge of the mathematics of perspective drawing, constituted a deliberate aesthetic strategy on Brunelleschi's part. Wittkower writes: "E. Panofsky was, I think, the first to formulate that 'from the point of view of the Renaissance, mathematical perspective was not only a guarantee of correctness but also, and perhaps even more so, a guarantee of aesthetic perfection.'" Wittkower, "Brunelleschi and 'Proportion in Perspective,'" 275. Later Wittkower reinforces this aesthetic interpretation of Renaissance architecture as follows: "…it was only during the Renaissance that 'perspective ratios' became an essential element of stylistic consideration…and that everything was done to make the perception of a harmonic diminishing series in space a vividly felt experience." *Ibid*., 288.

[37] Wittkower, *Architectural Principles*, 2d. ed. (1962) and 3d. ed. (1971), 74. In earlier editions the passage reads: "Italian architects always strove for an easily perceptible ratio between length, height and depth of a building, and all villas by Palladio have that block-like quality. Idem, *Architectural Principles*, (1962) and 2d. ed. (1952), 66.

[38] *Ibid*., 2d. ed. (1962) and 3d. ed. (1971), 45.

[39] *Ibid*., 2d. ed. (1962) and 3d. ed. (1971), 46.

[40] *Ibid*., 2d. ed. (1962) and 3d. ed. (1971), 108 and 108 n 8.

[41] Wittkower, "Brunelleschi and 'Proportion in Perspective,'" 289.

[42] Wittkower, "Brunelleschi and 'Proportion in Perspective,'" 132 n 47. He cites Paatz as the source of this information. Walter and Elisabeth Paatz, *Die Kirchen von Florenz* 2 (Frankfurt am Main: Vittorio Klostermann, 1940), 471.

[43] Manfredi Mancigni, *Esequie del serenissimo Ferdinando II. gran duca di Toscana celebrate in Firenze dal serenissimo gran duca Cosimo III* (Florence: Stamperia di S.A.S. per il Vangelisti e Matini, 1671).

[44] For a summary of Wittkower's German art historical training, and thus possible insights into his attitude toward the object, see David Watkin, *The Rise of Architectural History* (London: The Architectural Press, 1980), 149-154.

[45] Cf. note 7, above, for Gardner's comments of 1926 contrasting the feeling of "religious emotion" of the Gothic cathedral with the "harmonious design based upon orderliness and proportion" of the Renaissance church.

[46] Wittkower, "Principles of Palladio's Architecture-II," 68-106.

[47] Wittkower, *Architectural Principles* (1949), 110-111; and Wittkower, *Architectural Principles in the Age of Humanism*, 2d. ed. (London: Alec Tiranti Ltd., 1952), 110-111.

[48] Wittkower, *Architectural Principles*, 3d. ed. (London: Alec Tiranti Ltd., 1962), 126; and *Ibid.*, 4th ed. (London and New York: W.W. Norton and Company, 1971), 126.

[49] *Ibid*. (1962 and 1972), 127.

[50] Wittkower, "Systems of Proportion," 15.

[51] *Ibid*., 16.

[52] *Ibid*., 17.

[53] Wittkower, "Systems of Proportion," 15-17; Idem, "The Changing Concept of Proportion," *Daedalus* 89 (1960), 201-202; Idem, *Idea and Image: Studies in the Italian Renaissance* (London: Thames and Hudson, 1978), Chapter 4: "The Changing Concept of Proportion," 116-117; Idem, *Architectural Principles*, 2d. ed. (1962) and 3d. ed. (1971), Appendix II: "The Problem of Commensurability of Ratios in the Renaissance," 158-161; and posthumously, Idem, *Architectural Principles in the Age of Humanism* (London: Academy Editions and New York: St. Martin's Press, 1988), Appendix IV: "Proportion in Art and Architecture," 150-152.

[54] John Summerson questions the overall premise underlying Geometry vs. Number in the following statement, which he never developed into a comprehensive critique: "To think of the 12th century as having witnessed a 'renaissance' is greatly to modify the customary view of Gothic and classic art as 'opposites'; and in fact this habitual thesis is in many ways highly unsatisfactory. It is a too obvious conclusion drawn from prima facie impressions.... And it is probably nearer the truth to think of the whole flow of European art as a classic stream, distorted for a period from its course, than to think of an opponent 'will to form' breaking in during a Gothic interval and disappearing again with the exhumation of antiquity during the *quattrocento*." John Summerson, "Antitheses of the Quattrocento," in Summerson, *Heavenly Mansions and Other Essays on Architecture* (New York and London: W.W. Norton, 1963), 24-25.

[55] Wittkower, *Architectural Principles*, 2d. ed. (1962) and 3d. ed. (1971), 160.

[56] Idem, "Systems of Proportion," 17.

[57] Idem, *Architectural Principles*, 2d. ed. (1962) and 3d. ed. (1971), 108. In the first and second editions this passage reads: "As far as we can see this is the only irrational number of importance

involved in Renaissance theory of architectural proportion." Idem, *Architectural Principles* (1949) and 2d. ed. (1952), 95.

[58] *Ibid*., 108 and 158; and Idem, "Systems of Proportion," 16. For discussions of the ratio $1{:}\sqrt{2}$ in medieval architecture, see for example: Paul Frankl, "The Secret of the Mediaeval Masons," *Art Bulletin* 27, (1945), 46-65; Howard Saalman, "Early Renaissance Architectural Theory and Practice in Antonio Filarete's Trattato di Architettura," *Art Bulletin* 41, (1959), 89-107; Lon R. Shelby, "The 'Secret' of the Medieval Masons," in: Bert S. Hall and Delno C. West, eds., *On Pre-Modern Technology and Science Studies in Honor of Lynn White, Jr.* (Malibu: California, Undena Publications, 1976), 201-219; *Gothic Design Techniques: The Fifteenth-Century Design Booklets of Mathes Roriczer and Hanns Schmuttermayer*, edited, translated, and introduced by Lon R. Shelby (Carbondale, Illinois: Southern Illinois University Press, 1977); and Peter Kidson, "A Metrological Investigation," *Journal of the Warburg and Courtauld Institutes* 53 (1990), 71 -97. Wittkower lists several geometrical figures that he claims "…formed the basis of medieval aesthetics," including the equilateral triangle and the "right-angled isosceles triangle," but does not mention what ratios are associated with them or how medieval architects used them. Wittkower, "The Changing Concept of Proportion," 201.

[59] Wittkower, *Architectural Principles*, 2d. ed. (1962) and 3d. ed. (1971), 160-161. Wittkower, however, provides no examples of the "precise moments of transition" to which he refers.

[60] Wittkower, "Systems of Proportion," 13.

[61] Matthew A. Cohen, "Ugly Little Angels: Deliberately Uneven Construction Quality in the Basilica of San Lorenzo in Florence,*" arq: Architectural Research Quarterly* 11, (2007), 276-89; Idem, "How Much Brunelleschi? A Late Medieval Proportional System in the Basilica of San Lorenzo in Florence," published in the *Journal of the Society of Architectural Historians* 67 (2008), 18-57.

[62] Matthew A. Cohen, "Ugly Little Angels Revisited," in Allison Dutoit, Juliet Odgers, and Adam Sharr, eds., *Quality Out of Control: Standards for Measuring Architecture* (London: Routledge, 2010), 79-91.

[63] Matthew A. Cohen, "The Lombard Connection: Northern Influences in the Basilicas of San Lorenzo and Santo Spirito in Florence," *Annali di architettura* 21 (2009), 31-44; and Cohen, "Quantification and the Medieval Mind."

2. Sets of Proportions in the San Lorenzo Nave Arcade Bays (with a Santo Spirito Comparison)

In his slim *Pocket Guide to Architecture*, we have seen, Patrick Nuttgens summarizes the significance of the Basilica of San Lorenzo in Florence in one sentence: "S. Lorenzo is notable for the precision of its proportions."[1] Indeed, the notion that the proportions of this building, guided by a mathematically rational set of proportions embedded in its dimensions, impart to it positive qualities such as precision, beauty, harmony, perspectival rationality and *all'antica* refinement, today stands as a virtual axiom of architectural history.[2] Survey textbooks are extremely important vehicles for summarizing and shaping both popular and scholarly perceptions of architecture, and Nutgens' statement is but a brief summation of a more detailed interpretation of the Basilica of San Lorenzo that has been retold, with slight variation, in virtually every art and architectural history textbook published during the past fifty years. Nevertheless, no one has ever determined, based on verifiable measurements, what the proportions of this building are, whether an intentional set of proportions exists in any part of it, and if so, what significance it may have held for early fifteenth-century Florentines. In this study I revisit these questions pertaining to sets of proportions in the Basilica of San Lorenzo─and for comparison in the Basilica of Santo Spirito as well─based on a comprehensive methodology that supports observation with documentary research.

2.1 Methodology: San Lorenzo Nave Arcade Bays

Although the comprehensive new surveys of the basilicas of San Lorenzo and Santo Spirito that I have recorded may be considered the foundation of this study, measurements alone can be misleading no matter how accurate and comprehensive they may be. Any large building contains enough complexity to justify virtually any hypothesis regarding architectural proportion. Search hard enough in the measurements and you will find what you seek—a process that scientists unceremoniously refer to as "data dredging." Indeed, since even consistent proportional patterns can be coincidental, distinguishing intentional proportions from coincidental ones may be considered one of the central challenges of the study of architectural proportion.[3] Conversely, documentary evidence pertaining to architectural proportion (proportion-1) can be equally misleading without corroboration through measurements and other forms of observation, for no building can ever be assumed to correspond to any verbal remark or graphic representation recorded on paper, no matter how authoritative it may seem to be. When preconceptions guide the research process, such as the belief that Renaissance architecture is based on whole number proportions, the risk of misinterpreting historical evidence only increases.

The present study addresses these concerns by using various types of observation-based and documentary evidence in complementary ways. In addition, it forgoes common preconceptions such as the Wittkower Paradigm, in particular the Geometry vs. Number theory contained within it, and the various beauty-in-proportion belief systems, in favor of a more open approach: Rather than interpret the basilica of San Lorenzo as the first Renaissance building, distinct from the medieval past, or as some expression of transition between the two periods, it examines the basilica as a product of the late medieval civilization from which it arose. By using comprehensive measurements, subjected to rigorous analysis, as a primary source in the study of the basilica of San Lorenzo, this study arrives at novel conclusions pertaining not only to sets of proportions, but to the question of attribution and early site conditions as well. (The survey and survey methodology are described in Appendix 9.1.)

This study of the San Lorenzo nave arcade bays began with two simple measurements taken at the floor level between two adjacent nave columns selected at random. The choice of the specific points of measurement was inadvertently innovative. Scholars have thus far acknowledged two types of intercolumnar measurement, termed "on center" and "in the clear."[4] There is a third type however, which I will term "plinth-to-plinth," and it constitutes the key to understanding the proportions of the basilica of San Lorenzo.[5] The distance between the plinths of Columns 9 and 10 (Figure 2-1), for example, is 564.0 cm, and the distance between the <u>farther edges</u> of the same two plinths is 797.5 cm (see Appendix 9.1). Note that when the larger of these measurements is divided by the smaller, the result is the square root of 2, with a negligible error of about 2 mm, or, 0.2–0.3%.[6] The ratio between these two measurements, therefore, is nearly exactly 1:√2. The only geometrical construction that will produce this ratio between two co-linear dimensions is a root-2 rectangle inscribed within a square.[7] Judging from photographs, merely as an initial exploration, this construction appears to correspond to the width-to-height proportions of each nave arcade bay, up to the tops of the column shafts (Figure 2-2).

This procedure of estimating key building heights by extrapolating from plinth-to-plinth measurements has a notable precedent: according to Brunelleschi's fifteenth century biographer, Antonio di Tuccio Manetti, when Brunelleschi, in his youth, studied the remains of ancient buildings with his friend Donatello "… they drew elevations, roughly in drawings, of almost all the buildings in Rome…. and in this way, when they were able to, they estimated the heights [by measuring] from base to base …." (*da basa a basa*). Since the bases of classical columns are typically equal in width to the plinths, we may assume that for Manetti "base-to-base" meant plinth-to-plinth.[8]

Even in light of Manetti's comment, however, we are as yet quite far from being able to hypothesize either that these observations constitute an accurate description of the proportions of the nave arcade bay, or that those proportions result from intention rather than coincidence. In order to propose and test such hypotheses, we need to determine: 1) the exact dimensions of the nave arcade bays, 2) how best to interpret and manage dimensional irregularities in a proportional analysis, and 3) when measurements reveal the presence of a particular proportional relationship (1:√2, for example) within an acceptable level of dimensional tolerance, how to establish that it is the result of intention rather than coincidence.

In this study, a proportional relationship found within the measurements will be considered a likely product of the architect's intentions if it meets the following three criteria:

Criterion #1: The proportion must match the building measurements within the range of construction and measurement error established by statistical analysis. If a proportion fails to meet this standard but nevertheless appears, in the opinion of the author, to be intentional, it may remain under consideration if some convincing historical explanation, supported by documentary or observation-based evidence, can be found to account for all dimensional discrepancies.

Criterion #2: The proportion must appear in documentary sources relevant to the early fifteenth century, or closely resemble other proportions that do.

Criterion #3: The proportion must be related to other proportions in the building as part of a logical *set* of proportions that occur *simultaneously* within the measurements.

2.2 Refining the Survey Data: Metrical Observations

Seen from the floor with the unaided eye, all the bays of the nave arcades appear identical (Figure 2-3). Sighting along the tops of the columns from scaffolding, however, irregularities in the column heights become clearly visible (Figure 2-4). The bar charts indicate that the most pronounced of these irregularities are concentrated in the five easternmost bays of the nave, or to the outsides of the thin vertical lines in each chart (Figure 2-5).

The single largest height difference between any two adjacent columns in the nave is the 10.8 cm difference between the heights of Columns 12 and 13 (Figure 2-4, second and third columns from the right; see Figure 2-1 for column numbers). That this discrepancy is virtually all constructive, and not due to uneven foundations, is proven by the measurement breakdowns in the survey. The two column capital heights are identical at 96.9 cm each, but the monolithic shaft of Column 13 is taller than that of Column 12 by 6.7 cm, the base is taller by 2.1 cm, and the plinth by 0.7 cm, for a total of 9.5 cm, all contained within the masonry units and their mortar joints. Virtually all of the remaining 1.3 cm of difference (10.8 – 9.5 = 1.3) is due to the slightly raised foundation beneath Column 13, which rises 1.2 cm higher than that beneath Column 12 (for measurements, see Appendix 8.1).

While Column 13 consequently stands out as the most pronounced height anomaly of the north arcade, that distinction might have gone to Column 11 had the masons not taken what appears to have been remedial action. The monolithic shaft of Column 11 is taller than that of Column 13, albeit by a mere 0.7 cm, but this excess height was compensated for in the manufacture of the base and plinth for this column. These two elements are together 8.6 cm shorter than those of Column 13. An unusually short entablature block atop Column 11 (Figure 2-5, upper right), furthermore, makes the total order height measured at this column consistent with most others in the nave (Figure 2-5, lower left). No such remedial action was taken at Column 13, however, and so it remains unusually tall in the nave, whether measured to the top of the capital (Figure 2-5, lower right) or the entablature block (Figure 2-5, lower left).

The survey also calls our attention to Column 4 as the shortest column in the basilica. Here the masons appear to have taken a different kind of remedial action, for close inspection reveals that this column contains the only bilithic shaft in the basilica (Figures 2-6 and 2-7). Perhaps the shaft was damaged in transit to the site from the quarry or *bottega*, or perhaps it was originally made grossly too short or too tall. Whatever the problem, evidently the solution, rather than make a whole new shaft, was simply to make a new top, matched so precisely that only a mortar joint and a slight shaft height deficiency betray the repair.

All the significant dimensional irregularities in the nave arcades—and with them, all the remedial actions which, as we have seen, are themselves rather irregularly deployed—are concentrated in the five easternmost bays, or to the outsides of the thin vertical lines in the bar charts in Figure 2-5. If connoisseurship teaches us that judgments of artistic quality can be elevated to the level of empirical historical evidence, then it may now be useful to observe that the capitals and entablature blocks in these areas of greatest dimensional irregularity are also notably cruder in design than their counterparts in the western three bays, and rife with mistakes, corner-cutting, and sloppy workmanship—a sharp contrast to the exceptionally well crafted western three bays, as discussed in greater detail below (Figures 2-8 to 2-21).

Since my survey reveals countless slight dimensional irregularities from one nave arcade bay to the next, even though all bays appear to have been intended to be identical, this study examines the dimensions of *all* the bays, as a group, using statistical analysis. Such analysis accounts for dimensional irregularity by examining proportions in the non-definitive terms of probability. For example, since any given width-to-height proportion, defined between a particular set of points, is slightly different in each of the sixteen nave arcade bays, at best we can make an informed conjecture as to which single width-to-height proportion was intended for that set of points in every bay, identically. To do so, we can use the measurements to calculate a "confidence interval" within which a particular proportion, such as that of the root-2 rectangle, can be said, with 95% confidence, to be present in the nave arcade bays. The smaller and fewer the irregularities, the smaller the interval, and the more precise our conjecture can be.[9] Unfortunately, the dimensional irregularities in the nave arcades are too large to permit a sufficiently precise conjecture regarding the proportions of the arcade bays. Most of the heights of the nave columns vary by no more than a centimeter or so from one to the next, but a few of them vary by as much as 14 cm—discrepancies large enough not only to muddy proportional calculations, but to be visible from certain vantage points (Figure 2-4). A simple solution to this problem would seem to be to ignore the most pronounced irregularities, which appear as notable spikes and dips in bar charts representing the measurements (Figure 2-5). To remove these measurements from consideration, however, requires historical evidence that the more regular measurements are indeed more likely to represent the original design intentions than the notably irregular ones. This evidence is found in both the physical fabric of the building and surviving documents.

2.3 Refining the Survey Data: Sculptural Observations

The column capitals in the western three bays of the nave are sumptuously articulated with acanthus leaves that appear fleshy and alive (Figures 2-8, 2-10, 2-12 and 2-14). Some even bear delicate triplets of sickle-shaped incisions that are only visible at close range (Figure 2-12). The capitals in the eastern four bays, by contrast, appear stiff and stylized, articulated with pointed leaflets of unvarying thicknesses and squared-off edges, as if cut from thick sheets of rolled dough (Figures 2-9, 2-11, 2-13 and 2-15). Throughout the capitals and entablature blocks, highly polished surfaces in the western bays contrast with rough, chiseled surfaces in the eastern bays (Figures 2-12 to 2-21]. Some of the surfaces of the eastern stonework are also pitted, indicating a lower quality of stone than in the western stonework (Figurs 2-16 to 2-17). These distinctions in quality are most pronounced in the entablature block friezes. In the western bays the pairs of carved winged angels are expressive and sublime. Some were probably commissioned from the celebrated Rossellino brothers (Figures 2-22 to 2-24).[10] In the eastern bays the carved angels appear clumsy and crude by comparison (Figures 2-25 to 2-26), occasionally distressingly so (Figure 2-27).

The masons responsible for the eastern portions of the nave arcades appear to have availed themselves of every opportunity to spare time and expense. In the western entablature blocks, all the egg-and-dart crown mouldings have nine eggs per side (Figure 2-24). Most of the eastern blocks only have eight, however (Figure 2-28), and some as few as seven (Figure 2-29). In the crown moulding located atop the ill-starred Column 13, the left-most of the eight eggs is much wider than the others, as if the mason had begun carving in haste from right to left, without first laying out equal subdivisions (Figure 2-28). A more serious mistake is found directly below this imperfect crown moulding. In all the other entablature block friezes in the nave the lamb faces left and looks right (Figures 2-22, 2-24 and 2-25). This one is backwards (Figure 2-28). The compound Corinthian pilaster capitals that terminate the arcades on the interior façade display similarly egregious errors: ill-fitting parts seem carelessly jammed together, the large gaps that remain having been filled with thick dabs of plaster (Figure 2-30). At the western ends of the arcades, by contrast, the corresponding pilaster capitals join up in perfect alignment (Figure 2-31).

These striking differences in quality between the western and eastern portions of the nave arcades allow us to identify the precise structural boundary between the two construction phases. Proceeding from west to east, the sculptural archivolts that spring from Columns 5 and 10 on opposite sides of the nave each undergo a notable change after the first mortar joint: the carved laurel motifs become more simplified and crudely executed, and the spiraling carved leather bindings become thicker and reverse direction (Figures 2-32 and 2-33).[11]

Documentary evidence confirms what these observations suggest: the nave was built in two distinct phases. The first, from 1446 to 1450, took four years, and included six columns (see Figure 2-1, Cols. 5-10). The second, from 1461 to 1464, took three years, but included eight columns (see Figure 2-1, Cols. 1-4 and 11-14).[12] More work in less time generally leads to lower quality, as Cosimo de' Medici, the patron for both phases, must have been acutely aware. Already ailing by 1461 and anxious to complete this basilica that he had conceived as his own grand mausoleum lest his heirs be unable to do so, Cosimo appears to have ordered the remaining five bays of the nave (encompassing eight columns) rushed to completion (see Chapter 5). This novel historical interpretation of the nave construction provides the necessary justification to drop the measurements of the later portion of the nave from the data used in this analysis.[13] Doing so causes the standard deviations for all dimension sets to drop substantially, and the accuracy of all proportional calculations to improve enough to virtually eliminate ambiguity in the results (Appendix 9.4).

2.4 Geometry

The proportional calculations presented earlier in this chapter confirm our initial observation that the distance between the nearer edges of any two adjacent column plinths (first measurement) and the farther edges (second measurement) correspond to the ratio $1:\sqrt{2}$ with negligible error. They also indicate that an overlapping square and root-2 rectangle, when drawn to touch the edges of the column plinths, does indeed rise to the tops of the column shafts (Figure 2-2), though a seemingly minor discrepancy of 1.5% (about 11-12 cm) in this alignment falls outside the statistically allowable limits established for this study (Figure 2-5).[14] These calculations also indicate that a variant of the root-2 rectangle known as a "dual diagon," when inscribed between the column plinths, corresponds to the heights of the San Lorenzo entablature blocks within just 0.05%, or, about 0.5 cm (Figure 2-34).[15]

The overlapping square and root-2 rectangle shown in Figure 3-2 can be derived through a simple geometrical procedure known as "the rotation of squares technique." As such, it resembles the technique for determining the ground plan proportions of a Gothic pinnacle described in *Booklet Concerning Pinnacle Correctitude*, the mason's manual of Mathes Roriczer which was published in 1486, but very likely records a centuries-old oral tradition (Figure 2-35).[16] Roriczer's manual is a pragmatic work that reveals a method for determining the "correct proportions" (*Gerechtigkeit*) of a Gothic pinnacle through a series of illustrated, step-by-step instructions. In the first three steps Roriczer instructs his readers to draw three diminishing squares, one inscribed within the next, each turned forty-five degrees relative to the previous one (Figure 2-35, top left). In the fourth step Roriczer instructs his readers to "rotate the square e h g f," meaning the middle square, until its sides are parallel to those of the other two (Figure 2-35, bottom left). In the fifth step the sides of the innermost square are extended to touch the sides of the newly rotated middle square, thus closing off the corners of the middle square to form four much smaller squares (Figure 2-35, top right). In subsequent steps he describes smaller geometrical manipulations (Figure 2-35, bottom right). The completed figure, he tells us, represents the floor plan (in collapsed view) of the shaft of a pinnacle. To determine the height of the shaft, he multiplies the width of the largest square by six, thereby deriving the height from the floor plan. The spire on top of the pinnacle rises another seven of these modules.[17]

The diagram in Roriczer's fifth step (Figure 2-35, top right), when simplified to exclude the outermost square (Figure 2-36, third iteration), corresponds precisely to the floor plan of each bay of the San Lorenzo side aisles, provided that the side aisle pilaster plinths are imagined to project into the walls as full squares (Figure 2-1). Of the two large squares in our simplified Roriczer diagram (Figure 3-36, third iteration), the width of the smaller of them corresponds to the plinth-to-plinth distance at San Lorenzo, and the width of the larger one, to the distance between the farther edges of the column plinths (Figure 2-2). We know that these two squares bear a 1: $\sqrt{2}$ relationship to one another, just like the two plinth-to-plinth distances of San Lorenzo, because before we rotate the smaller square, we can plainly see that its diagonal is equal in length to the sides of the larger square (Figure 2-36).

If we now take our simplified Roriczer diagram (Figure 2-36, third iteration), stand it up for use in elevation, and remove the two inside horizontal lines (Figure 2-36, fourth iteration), we have the San Lorenzo nave arcade proportions of overlapping square and root-2 rectangle (Figure 2-2). We have previously seen that the dual diagon that marks the heights of the San Lorenzo entablature blocks can be derived from a root-2 rectangle inscribed between the column plinths (Figure 2-34). The Roriczer diagram now suggests another way to derive this figure: in the preceding operation we removed two horizontal lines that formed narrow bands along the top and bottom of the figure (Figure 2-36, fourth iteration). If we were now to duplicate these bands instead of removing them, and to add the duplicates to the top and bottom of the geometrical figure, the two innermost vertical lines of the new figure would describe the sides of a dual diagon. Such a geometrical elaboration would be in the spirit of Roriczer's technique, which consists of incremental permutation of a basic figure of rotated squares.

The overlapping geometrical set of proportions shown in Figure 2 bears even closer similarities to the proportions contained in certain illustrations in Sebastiano Serlio's *Secondo Libro* of 1545 and *Terzo Libro* of 1540.[18] Serlio frequently invites his readers to measure the proportions of his illustrations directly, and I have done just that, working from original editions.[19] Two of Serlio's illustrations bear the same proportions of overlapping square and root-2 rectangle observed at San Lorenzo, with errors of 1–2 millimeters, or, 0.5% (Figures 2-37 and 2-38, and Appendix 8.5).[20] Serlio even includes a pavement pattern of rotated squares in one of them (see Figure 2-37), perhaps as a hint to help his readers reconstruct the illustration's proportions. In this context it may be significant that several of the San Lorenzo nave windows contain wooden muntins, perhaps original, arranged as rotated squares (Figure 2-39). The dual diagon proportion is also found, with similar accuracy, in certain illustrations of Roman buildings in Serlio's *Terzo Libro* (Figures 2-40 and 2-41, and Appendix 8.5).[21] We know that the latter proportions are of Serlio's invention, and not based on measurements of the buildings themselves, because Serlio explicitly tells us so.[22]

Additional documentary support for the preceding geometrical interpretation of the San Lorenzo nave arcade bay proportions is provided by a variety of sources. In *De architectura*, Vitruvius recommends three rectangles having the proportions 3:5, 2:3 (a square-and-a-half rectangle) and $1:\sqrt{2}$ (a root-2 rectangle) for the proportions of the atria of Roman houses.[23] This treatise, which had been widely disseminated by the late medieval period—indeed, Nicola Acciaioli willed a copy to the church of San Lorenzo in 1359, and Giovanni Bocaccio willed another to a monk of the church of Santo Spirito in 1374—thus established a canon of rectangular proportions that was elaborated upon in every architectural treatise of the Renaissance.[24] Filarete, in his fifteenth-century Trattato di architettura, recommends a slight modification of the Vitruvian canon of rectangular proportions for use in the designs of doorways and arched portals. For such purposes

Filarete variously recommends the ratios 1:2 (a two-square rectangle), 1:√2 (a root-2 rectangle) and 1:1 1/2 (a square-and-a-half rectangle).[25] Alberti recommends two of these proportions for doorways, 1:2 and 1:√2; and a different selection of four rectangular proportions for arcade and colonnade bays.[26] Francesco di Giorgio Martini presents a complex array of ten simple quadrangular proportions for rooms and courtyards.[27] The one rectangular proportion common to all of these authors is 1:√2 (a root-2 rectangle).

These observations suggest that architects and masons of both the medieval and Renaissance periods shared a common geometrical tradition incorporating root-2 proportional relationships. Indeed, Serlio even includes the rotation of squares technique on the title page of his *Primo libro* as one of the fundamental tools of the architect, together with the compass, plumb line and set square (Figure 2-42). Similarly, the author of the *Antiquarie prospectiche Romane* (c. 1500), probably Bramante, included a figure of rotated squares in his title page illustration that depicts an architect, perhaps himself, surrounded by ancient Roman monuments and the instruments needed to study them (Figure 2-43).[28] Thus, to describe this technique as a primarily medieval phenomenon, as many scholars do, is to deny its continued importance during both the medieval and Renaissance periods; and to interpret rotation of squares-related proportions at San Lorenzo as medieval characteristics in an otherwise Renaissance building would be inaccurate.

2.5 Number

Geometry can be used to establish architectural proportions, but geometry's companion, number, is needed to translate those proportions into built form. Number gives architecture quantity and dimension. The architect had to communicate to the masons quantitative information such as how many columns were needed, how tall they were to be and how far apart they were to be, and number provided the simplest means by which to do so. Number also gives architecture scale. Any geometrical proportion can be executed at the jeweler's scale of a reliquary, the monumental scale of a major cathedral, or any increment in between. At San Lorenzo, number allowed the architect to reconcile abstract geometry with dimensioned proportions at a scale appropriate to the site, budget and civic importance of the basilica. Number, however, has two sides: number can represent magnitude, and number can represent itself. This second side—the vast intellectual landscape of number divorced of magnitude—constituted a significant branch of western thought prior to the Industrial Revolution of the eighteenth and nineteenth centuries. Aristotle (384–322 B.C.) described this dual nature of number in a discussion of time, as follows:

"...Since 'number' has two meanings (for we speak of the 'numbers' that are counted in the thing in question, and also of the 'numbers' by which we count them and in which we calculate), we are to note that time is the countable thing that we are counting, not the numbers we count in—which two things are different."[29]

Johannes Kepler (1571–1630) reaffirmed this distinction between dimensioned and un-dimensioned numbers, terming the former "counted numbers" (*numeri numerati*), i.e. the quantities that we count; and the latter, "counting numbers" (*numeri numerantes*), i.e., the numerals with which we count.[30] Although we still recognize this distinction today, we rarely assign much importance to un-dimensioned numbers, which we find, for example, on automobile license plates and athletes' jerseys; or in popular superstitions such as lucky number 7 and unlucky (in America) or lucky (in Italy) number 13. For architects of the medieval and Renaissance periods both sides of number were equally important, and the distinction between them was paramount. Dimensioned numbers were for them utilitarian instruments while un-dimensioned numbers, which could simply be dimensioned numbers interpreted in a different way, represented abstract values that formed hierarchical patterns of infinite beauty and complexity. Thus, dimensioned numbers linked architecture to the mundane, while un-dimensioned numbers linked architecture to an abstract intellectual and perhaps even spiritual realm.

We can find the dimensioned numbers within the San Lorenzo nave arcade sets of proportions by converting key measurements in the survey from meters and centimeters to the early fifteenth-century Florentine *braccio.* This conversion is a two-step process: first the measurements are divided by the correct centimeter equivalent of one braccio, which appears to be the widely accepted standard of 58.36 cm, derived from an eighteenth century campione conserved in the Florentine state archives (Figure 2-44).[31] Second, any decimal remainders are converted to the correct system of braccio subdivision. That system consisted of simple fractions and not, as many scholars believe, the more complex system of soldi and denari, which does not appear to have come into use until the sixteenth century.[32]

Converted to braccia, these dimensioned numbers immediately begin to communicate in the terms of their un-dimensioned alternate identities. Note that most of the nave arcade dimensions end in the fraction $\frac{2}{3}$ (Figure 2-45): the capital heights measure $1\frac{2}{3}$ br (approximately 1.659 br); the plinth-to-plinth distances, $9\frac{2}{3}$ (approximately 9.662); the distances between the farther edges of the column plinths, $13\frac{2}{3}$ (approximately 13.669); and the minor order height to the tops of the entablature blocks, $17\frac{2}{3}$ (approximately 17.637).[33] Furthermore, if we assume that the column shaft heights were intended to correspond to the overlapping square and root-2 rectangle shown in Figure 2-2, the aforementioned 11-12 cm discrepancy for now notwithstanding, then the heights of the column shafts would also measure precisely $13\frac{2}{3}$ br. When all these dimensions ending in $\frac{2}{3}$ are separated out, arranged in order of magnitude (understood as abstract magnitude rather than measurable dimensions), and the duplicates removed, the following number progression results:

$$1\frac{2}{3},\ 9\frac{2}{3},\ 13\frac{2}{3},\ 17\frac{2}{3}$$

The fractions, having served their graphic functions as flags calling out these dimensions as a group, may now be removed:

$$1,\ 9,\ 13,\ 17$$

Note that the intervals between these numbers are 8, 4, and 4,

$$\begin{array}{ccccccc} 1 & & 9 & & 13 & & 17 \\ & \vee & & \vee & & \vee & \\ & 8 & & 4 & & 4 & \end{array}$$

which imply that a 5 is missing from the progression. When it is included, the intervals become a series of repeating 4s:

$$\begin{array}{ccccccccc} 1 & & (5) & & 9 & & 13 & & 17 \\ & \vee & & \vee & & \vee & & \vee & \\ & 4 & & 4 & & 4 & & 4 & \end{array}$$

Why this 5—or more pertinently, the dimension $5\frac{2}{3}$ br—might be missing from the nave arcade bay dimensions will be discussed below. Even without it though, any educated person of the early fifteenth century would have recognized the progression 1, 9, 13, 17 as a small, if incomplete, piece of a vast network of similar progressions, all interrelated according to the principles of Boethian number theory. Once a cornerstone of western learning and virtually synonymous with the very concept of number during both the medieval and Renaissance periods, Boethian number theory has been all but forgotten today.[34] Thus, a brief review is in order.

In about 503 A. D., Anicius Manlius Severinus Boethius (c. 480–c. 525 A. D.)—a Roman aristocrat, philosopher, and advisor to the Ostrogoth King Theodoric[35]; dubbed "the first scholastic and last Roman" by historian E. K. Rand [36]; an early Christian who was tortured to death, placed in *Paradiso* by Dante[37] and revered as a saint for centuries before his cult was confirmed in 1883[38]; and who is today best known as the author of *The Consolation of Philosophy* (*De consolatione philosophiae*)—gave to the Latin West a translation and slight elaboration of a Greek treatise on arithmetic, written by Nicomachus of Gerasa in about the first century A. D., that would serve as the basis of mathematical knowledge in Europe for over a millennium.[39] The fundamental importance of Boethius's *De institutione arithmetica*, which was completed in about 503 A. D., to the history of mathematics is reflected in an illustration in the *Margarita philosophica*, a popular and widely disseminated encyclopedic digest first published a millennium later, in 1503. In the illustration, Boethius is depicted as equivalent in importance to Pythagoras, the man considered since antiquity to be the father of all number theory (Figure 2-46).[40] By the early fifteenth century copies of *De institutione arithmetica* could be found in all the major libraries of Europe.[41]

According to Boethian number theory, which is rooted in Neo-Pythagorean doctrines, numbers are philosophical rather than utilitarian instruments, and occur in progressions rather than individually.[42] Each progression is identified by the intervals between the consecutive numbers of which it is composed, and these intervals in turn form new progressions. Boethius describes many different classes of numbers, but devotes particular attention to those that "deal with geometric figures,"[43] and these numbers—let us call them geometrical numbers—may be considered the foundations of Boethian number theory.[44] There are three principal types of geometrical numbers: linear (let us call them one-dimensional), polygonal[45] (two-dimensional), and pyramidal (three-dimensional). These numbers are written as sets of dots or pen strokes[46] arranged as lines, polygons; and, in certain Renaissance and later sources, axonometric pyramids, respectively. In Boethian number theory every progression of geometrical numbers begins with, 1, or "unity," an entity that is considered to be the basis of all numbers but is not itself considered to be a number, just as in classical geometry the point is considered to be the basis of all geometry but is not itself considered to be geometrical because it has no dimension.[47]

The *Liber mathematicalis bernwardi*, c. 1000, conserved in the archives of St. Michael's Church in Hildesheim, includes a manuscript of *De institutione arithmetica* that contains one of the earliest surviving illustrations of the so-called "polygonal numbers" (Figure 2-47).[48] In it, the "triangular numbers," 1, 3, 6, 10, 15, 21, 28…, are shown as pen strokes arranged as triangles; the "square numbers"—a term we still use today—1, 4, 9, 16, 25, 36, 49..., as pen strokes arranged as squares; and so on through the polygons. The intervals between the polygonal numbers produce new progressions of numbers variously called "root numbers" or "gnomons," and the root numbers produce intervals—for clarity let us call them "root intervals"—that consist of repeated integers.[49] The polygonal numbers themselves constitute the intervals between the so-called pyramidal numbers, which may be visualized as stacks of cannonballs. The polygonal numbers illustrated in the Hildesheim manuscript are broken down into these various intervallic progressions in Figure 3-48. Note that the root hexagonal numbers begin with the now familiar progression 1, 5, 9, 13, 17, the same one found at San Lorenzo.[50]

Boethian number theory may be understood as a fundamental part of the intellectual framework underlying the medieval world view. Its influence can be found, for example, in the many *trattati d'abbaco* (schoolbooks of arithmetic) that appeared in Florence in the fourteenth and fifteenth centuries, in mathematician Gabriele Stornaloco's famous letter of 1391 regarding the proportions of the Cathedral of Milan, in Alberti's remarks about number, and even in the rules underlying the medieval number game *rithmomachia* which prominently incorporates the squares of the progression 5, 9, 13, 17, among many other Boethian number relationships.[51]

2.6 Arithmetic

Geometry and number give architecture buildable form, but sometimes the two simply refuse to work together. When Vitruvius attempts to calculate the length of the diagonal of a 10 foot x 10 foot square he concludes: "nobody can find this by means of arithmetic."[52] Serlio warns of the similar difficulty posed by the root-2 rectangle, noting: "...[it] is irrational; one finds no whole number proportion at this increment."[53] Many scholars incorrectly assume that architects and masons of the medieval and Renaissance periods lacked the mathematical knowledge necessary to calculate the length of the diagonal of a square of known numerical width and that, when using such a diagonal to determine the heights of columns, vaults or other tall features (see Figure 2-2), they laid out the square full-scale on the ground and measured the diagonal with a piece of chain or string in order to avoid using numbers.[54] Wittkower, for his part, claims that the side/diagonal and other irrational ratios ran contrary to "the new organic approach to nature" that characterized the "Renaissance attitude to proportion" and that consequently, whole number ratios constitute "the nodal point of Renaissance aesthetics."[55] Such speculations would seem to have little relevance to the San Lorenzo proportions, however, for my measurements indicate that while the architect who designed them indeed regarded the irrationality of the side/diagonal ratio with special interest, far from avoiding it in favor of number, he engaged it numerically with great bravura.

At San Lorenzo, we have seen, he expressed the irrational ratio 1:√2—that is, the proportions of the root-2 rectangle—with the numerical ratio $9\frac{2}{3} : 13\frac{2}{3}$, with no apparent dimensional compromise.[56] How did he do it? The ratio $9\frac{2}{3} : 13\frac{2}{3}$ is not a true numerical expression of the side/diagonal ratio (no such expression is possible), but an extremely accurate approximation thereof. The error, four one-hundredths of one percent (0.04%), translates into about 1-3 mm at the scale of the San Lorenzo nave arcades. Since even in the extremely accurately constructed western portion of the nave the degree of construction error is about ten times larger, or, 1-2 cm, for the purposes of architecture the ratio $9\frac{2}{3} : 13\frac{2}{3}$ may be considered numerically *equivalent* to the ratio 1:√2.[57]

The use of precise numerical approximations of the side/diagonal ratio was far from new in the early fifteenth century. The Old Babylonians knew how to calculate them, Plato refers to them in the *Republic*, and in the first century, A.D., the mathematician Theon of Smyrna wrote a treatise that presents a simple formula for calculating an infinite progression of them.[58] Since a copy of Theon's treatise reached Florence by the mid-fifteenth century (it was translated by Marsilio Ficino for Cosimo de' Medici) and since Theon's formula helps to illuminate a particular characteristic of the San Lorenzo sets of proportions that appears to have been progressive for its day, the formula deserves our close attention.[59] Theon's formula begins with a theoretical square, the dimensions of the side and diagonal of which are 1, or unity. It then generates successive theoretical squares according to the following relationships: the sum of the side and diagonal (s+d) of the first square generates the side of the next square, and twice the side plus the diagonal (2s+d) of the first square generates the diagonal of the next square. The second square in the progression thus has a side/diagonal number pair of 2:3, which is a poor approximation of the ratio 1:√2 (error: 6.07%). Successive generations—5:7 (error: 1.01%), 12:17 (error: 0.17%), 29:41 (error: 0.04%)—approximate this ratio with a roughly six-fold increase in accuracy with each generation, and continue to improve as such *ad infinitum* (Figure 2-49).[60] Theon's formula, however, would not have been very useful to architects working much before the years in which the San Lorenzo sets of proportions were designed. As the numerical approximations that it generates increase in accuracy, so too do they increase in magnitude, and all but a few of them are simply too large relative to common units of measure such as the Florentine braccio to have had much practical application. The San Lorenzo architect, however, possessed a new tool, in widespread use perhaps only since the mid-fourteenth century, that allowed him to overcome this problem.

Common fractional arithmetic was the new math of the late fourteenth and early fifteenth centuries, the most significant development in the use of number in the West since the displacement of Roman in favor of Hindu-Arabic numerals in the thirteenth and fourteenth centuries.[61] The *Trattato d'aritmetica* by Paolo dell'Abbaco (c. 1281–1374) is a particularly useful source of insight into the mathematical knowledge of the period because its author was both an esteemed mathematician in Florence, and master of his own well-regarded school of arithmetic (*scuola dell'abbaco*) in which this *trattato* very likely served as a required text.[62] The *Trattato* consists of 197 word problems, nearly every one of which involves fractional calculations difficult enough to tax the mathematical skills of any junior high school student—not to mention many adults—today.[63]

Also central to the curricula of the *scuole del'abbaco* in fourteenth and fifteenth century Florence was the concept of equivalent ratios. Pier Maria Calandri notes in his *Tractato d'abbacho*, for example, that the progression 8, 12, 18, 27 is composed of "proportional quantities" (*quantità proportionali*) because the ratio 8:12 (denoted verbally as *8 a 12*, or, "8 to 12"), represents the same ratio as 12:18 and 18:27—i.e., they all represent the irreducible whole number ratio of 2:3.[64] Combining his knowledge of fractional arithmetic and equivalent ratios, the architect of the San Lorenzo sets of proportions understood that any numerical ratio that included fractions could be converted to an equivalent whole number ratio, and vice versa, through simple arithmetic. He thus realized that he could capture the impressive accuracy of the ratio 29:41 as a side/diagonal approximation, perhaps derived from Theon's formula (see Figure 2-49), while reducing that ratio to a smaller, more practical scale relative to the Florentine *braccio*, as follows:

$$29{:}41 \;\Rightarrow\; \frac{29{:}41}{3} \;=\; \frac{29}{3} : \frac{41}{3} \;=\; 9\frac{2}{3} : 13\frac{2}{3}$$

These fractional calculations bear a particular resemblance to the solutions to three word problems explicated in Paolo dell'Abbaco's *Trattato d'aritmetica*, and shed light on the new opportunities that common fractional arithmetic opened up to architects who were interested in reconciling two of the principal sciences of the medieval and Renaissance periods—geometry and arithmetic—in the one area in which they seemed diametrically opposed: geometrically-derived magnitudes that in theory cannot be expressed in terms of number.[65] Indeed, such reconciliation of apparent opposites in the San Lorenzo sets of proportions could possibly have taken on philosophical or even religious significance for those early fifteenth-century intellectuals who were aware of them.[66]

2.7 The Column Shaft and Entablature Block Height Discrepancies

Our analysis of the overlapping square and root-2 rectangle shown in Figure 2-2 has proceeded even though the survey indicates that when this geometrical construction is drawn to touch the edges of the column plinths, the top line lands along a smooth, architecturally undistinguished area 11-12 cm below the tops of the column shafts, rather than aligning precisely with the tops of those shafts as I propose the architect intended. A convincing historical explanation for this discrepancy must now be provided. I propose that the masons, perhaps working from incorrect or ambiguous information, mistakenly made the column shafts 11-12 cm taller than the architect wanted them. I furthermore propose, since the present minor order height of $17\frac{2}{3}$ br and the present capital height of $1\frac{2}{3}$ br both appear, in light of the preceding analysis, to correspond precisely to the architect's intentions, that the excess 11-12 cm of shaft height came at the expense of the originally intended entablature block height. The entablature blocks presently measure about 2.13 br in height, which is 11-12 cm short of $2\frac{1}{3}$ br (2.33 br).[67] An entablature block height of $2\frac{1}{3}$ br plus the present capital height of $1\frac{2}{3}$ br would equal 4 br, or, twice the plinth width of 2 br.[68] The dimension $2\frac{1}{3}$ br thus has a ring of intention to it, even in the absence of the additional supportive evidence now to be examined.

The construction error hypothesis stated above is supported by three categories of evidence. The first is the subtle and complex San Lorenzo nave arcade sets of proportions themselves, and their thorough consistency with late medieval learning. That these sets of proportions, with their cunning integration of geometry, number and arithmetic, might have come about by coincidence seems highly unlikely. These sets of proportions only come to light, however, when we correct the masons' apparent 11-12 cm mistake by imagining that the column shafts measure $13\frac{2}{3}$ br high (and not 11-12 cm higher, as at present), and the entablature blocks, $2\frac{1}{3}$ br (and not 11-12 cm lower, as at present).

The *present* column shaft and entablature block heights, by contrast, lack any apparent logical basis whatsoever.

The second category of evidence in support of my construction error hypothesis is provided by the basilica of Santo Spirito, which I also measured comprehensively. In that basilica, which Brunelleschi designed in the 1430s with striking stylistic and compositional resemblances to the basilica of San Lorenzo, the top of a root-2 rectangle inscribed between the plinths of any two adjacent columns aligns with the tops of the column shafts, not including the astragals, with absolute statistical precision, exactly as I have proposed this proportion was intended to align at San Lorenzo (Figure 2-50 and Appendix 8.3).[69] Furthermore, the Santo Spirito capitals measure $1\frac{2}{3}$ br high (or, the same as those of San Lorenzo), and the entablature blocks measure $2\frac{1}{3}$ br high—exactly the dimension I have proposed was intended at San Lorenzo. Thus, Brunelleschi appears to have used the San Lorenzo nave arcade sets of proportions (whether or not he was their author), absent the future construction errors, as the basis for his design of the Santo Spirito arcade sets of proportions (to be considered in greater detail below).

The third category of evidence in support of my construction error hypothesis consists of early documentary accounts that describe numerous divergences from Brunelleschi's intentions in the construction of all the works traditionally attributed to him. Whether or not Brunelleschi designed the San Lorenzo nave arcade sets of proportions, he clearly played a significant role in shaping the present above-ground form of the basilica during his brief term as *capomaestro* early in the construction process. Manetti notes that Brunelleschi continually grappled with the problem of construction error, and while repeatedly lambasting those who, in his estimation, bore responsibility for these divergences, does not hesitate to lay some of the blame in the master's own lap.[70] According to the biographer, Brunelleschi, ever fearful that others would "discover his every secret" (*intendessi ogni suo segreto*), was notoriously ambiguous when documenting his designs in drawings and models, preferring instead to give verbal instructions directly to the masons as they worked (*a bocca di mano in mano*). Indeed, Manetti specifically notes that "…he worked in this way at San Lorenzo…."[71] This method of communication, according to Manetti, led to significant errors in several buildings, particularly pertaining to capitals, entablatures and other ornamental articulations of structure (*capitelli o d'architravi, fregi, e cornici ecc.*). These errors, he notes, caused Brunelleschi "much annoyance and sorrow" (*molte noie e rincrescimenti*) when he invariably discovered them too late to correct them.[72]

Manetti singles out the Ospedale degli Innocenti as a building that suffered particularly egregious departures from Brunelleschi's intentions during one of the architect's frequent absences from Florence, a claim consistent with that of the early sixteenth century biographer Antonio Billi. Manetti notes that during one of these absences the architect left just one drawing (*el disegno solo*), measured to scale (*misurato a braccia picchole*), and "…gave oral instructions (*e a bocca mostrò*) to the master builders, the stonecutters, certain citizens, the leaders of the Guild, and the workers assigned to the undertaking."[73] These instructions, however, appear to have been insufficient to avert, among other errors "…an architrave that turns down and continues to the water table of the building."[74] This down-turning architrave is indeed one of the oddest details in the Brunelleschi *oeuvre*—an apparent relapse to Romanesque improvisation in an otherwise rigorously classical, Early Renaissance façade—and Billi sees fit to elaborate upon the circumstances that brought it about. According to him, upon returning from a trip to Milan, Brunelleschi confronted Francesco della Luna, the *capomaestro* in charge of the work during his absence, and asked "why he made such a thing." Francesco replied that he had "taken it from the church of St. John" (i.e., the Baptistery of Florence), which Brunelleschi had apparently instructed him to follow in certain details. In one of the wittiest repartees in the history of architecture, Brunelleschi replied: "There is but one error in that building, and you have chosen to copy it."[75]

The errant nave column and entablature block heights of San Lorenzo appear to have originated with a problem involving applied architectural ornament very similar to the problem Brunelleschi encountered at the Ospedale. The errant dimensions in question must have been established as soon as the first minor order pilaster was installed in the transept, for the heights of its various component parts would have automatically established permanent horizontal benchmarks across the entire site of the future basilica, including both the transept and nave (Figure 2-51). That first San Lorenzo pilaster was installed in the first private chapel built in the basilica, the Medici double chapel (see Figure 2-1, SP 17-23), which was completed, together with the adjacent Old Sacristy, by 1428.[76] Though documentary evidence gives no reason to doubt that Brunelleschi supervised the construction of both the chapel and sacristy, the apparent dimensional errors in the pilasters suggest that his supervision either lapsed or ended soon after the chapel walls reached the most critical *structural* benchmark in the basilica—the height of the springing line of the minor order arches and vaults. That benchmark occurs precisely $17\frac{2}{3}$ br above the floor of the future basilica nave, and corresponds to the tops of the entablature blocks of the nave arcades and the corresponding entablature that circumscribes the entire basilica (see Figures 2-3 and 2-51). During this early period of construction Brunelleschi also appears to have supervised the manufacture, but not the installation, of the pilaster capitals that embellish the Medici Chapel in question, for the exceptionally high sculptural quality of these capitals (Figure 2-52), unmatched anywhere else in the basilica proper (Figure 2-53), seem to bear the imprint of his personal attention. These capitals display exceptionally smooth finish, and fine vertical ridges along the leaf stems that resemble metalwork (see Figure 2-52), perhaps a reflection of Brunelleschi's training as a goldsmith.

Brunelleschi appears to have missed his opportunity to establish correctly the next most important structural benchmark of the minor order—the height of the transept pilaster shafts, and by extension, the height of the future nave column shafts. He appears to have been absent when the pilaster capitals were mounted on the walls of the Medici Chapel, and to have neglected to leave any completed pilaster plinth + base assemblies, shafts, or entablature segments.[77] Imagine the hapless mason standing in the then-recently vaulted Medici double chapel, looking up at the horizontal springing line of the chapel vaults and arches, and wondering how far below it to mount Brunelleschi's pilaster capitals (see Figure 2-51, right). We now see that the mason simply needed to place the bottoms of those capitals (marked by the bottoms of the astragals) exactly 4 br below the springing line to accommodate the $2\frac{1}{3}$ br entablature height plus the $1\frac{2}{3}$ br capital height (see Figures 2-45 and 2-51), but for some reason he apparently never received that crucial piece of information. Perhaps Brunelleschi, with characteristic ambiguity, failed to transmit it to his successor as *capomaestro*, or perhaps his successor failed to pass it along to the mason. We may never know exactly what went wrong the day the first San Lorenzo pilaster took its place on one of the walls of the Medici Chapel. The apparent 11-12 cm errors in question, however, serve as valuable reminders that irregularity is the normal condition of architecture, and that no building can ever be assumed fully to reflect the architect's intentions.

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[1] Patrick Nuttgens, *The Pocket Guide to Architecture* (New York, 1980), 115.

[2] A typical and widely disseminated example of this view, including an admission of its speculative nature, is that of Janson: "What makes the interior of San Lorenzo seem so beautifully integrated? There is indeed a controlling principle that accounts for the harmonious, balanced character of his design: the secret of good architecture, Brunelleschi was convinced, lay in giving the 'right' proportions—that is, proportional ratios expressed in simple whole numbers—to all the significant measurements of a building. The ancients had possessed this secret, he believed, and he tried to rediscover it by painstakingly surveying the remains of their monuments. What he found, and how he applied his theory to his own designs, we do not know for sure." H. W. Janson, *History of Art*, 3rd ed. (New York, 1986), 410.

[3] Coincidental occurrences of highly ordered structures must be expected in architecture, as in geometry and mathematics. This phenomenon is aptly illuminated by Arnheim, who notes: "Only in a world based exclusively on the chance combination of independent elements is an orderly pattern a most improbable thing to turn up; in a world replete with systems of structural organization, orderliness is a state universally aspired to and often brought about." Rudolf Arnheim, *Entropy and Art: An Essay on Disorder and Order* (Berkeley, Los Angeles and London: 1971), 37. For a mathematical analysis of this phenomenon, see Roger Fischler, "How to Find the 'Golden Number' Without Really Trying," *Fibonacci Quarterly* 19, no. 5 (Dec. 1981), 406-410.

[4] According to Saalman, "[t]wo things required proportioning in Early Renaissance architecture: the building members (mass) and the spaces between them (void)…. All geometrical relationships are determined 'in the clear,' that is, from edge to edge of the building members, *not* from axis to axis." Saalman, *Brunelleschi: The Buildings*, 361; and Howard Saalman, "Early Renaissance Architectural Theory and Practice in Antonio Filarete's Trattato di Architettura," *Art Bulletin* 41, No. 1 (Mar., 1959), 94. Several references to "on center" dimensions are found in fourteenth century documents pertaining to the Cathedrals of Florence and Milan. A document of 1357 repeatedly refers to the dimensions between the nave piers in the church of Santa Maria del Fiore in Florence as "...from center of column to center of column..." ("...da meza cholonna a meza cholonna..."), as transcribed in: Cesare Guasti, *Santa Maria del Fiore: La Costruzione della Chiesa e del Campanile*, Firenze, 1887, p. 94. Similarly, in a letter of 1392, the mathematician Gabriele Stornaloco twice refers to the on center distances between the nave columns (piers) of the Cathedral of Milan: "The appropriate height is in accordance with the distance from center to center of the columns…" ("Competens altitudo est secundum distantiam centri ad centrum colonarum"), and: "I have taken all the widths

from center to center; therefore I have not bothered to enter into the drawing the thickness of the columns because it is sufficiently clear to the master architects how much they occupy within the bodies [scil., central nave and aisles] of the church." ("Omnes lactitudines acepi mensuratione centri ad centrum icdeo non curavi in designamento ponere spissitudinem colonarum quia satis est manifestum Magistris Inzigneriis quantum occupant in corporibus ecclesie..."), as quoted and translated in: Paul Frankl, "The Secret of the Medieval Masons", *Art Bulletin*, XXVII, 1, 1945, pp. 54 and 55. I have substituted Frankl's word "pier" for "column," which I believe more closely follows Stornaloco's text. In another example, Antonio di Vincenzo, architect of the church of San Petronio in Bologna, annotates his drawings of the Cathedral of Milan with the following reference to on center dimensions: "...from the center of the pilaster [i.e., pier] to the other center..." ("...da mezo del pilastro al altro mezo..."), as quoted in: James S. Ackerman, "'Ars Sine Scientia Nihil Est:' Gothic Theory of Architecture at the Cathedral of Milan," *Art Bulletin*, XXVI, 2, 1949, p. 88, n. 14). For references to in the clear measurement see: Vitruvius, *De Architectura*, III, iii, 7; and Leone Battista Alberti, *De re aedificatoria*, VII, v and VII, xv.

[5] When references to plinth-to-plinth measurement appear in the fifteenth century literature, scholars do not recognize them. Saalman, for example, accepts Enggass's translation of Manetti's words *da basa a basa*, quoted above, as "from base to base," but nevertheless interprets the passage to be a reference to the significantly larger "intercolumnal dimension measured from shaft to shaft." Antonio di Tuccio Manetti, *The Life of Brunelleschi*, Howard Saalman, ed., Catherine Enggass, transl., University Park and London, 1970, 34, 52 and 132 n. 33. In their translation of *De re aedificatoria*, furthermore, Rykwert et al. omit Alberti's word "base" (*basis*) from his description of the proportions of a portal flanked by two Corinthian columns, and with it, his reference to plinth-to-plinth (i.e., base-to-base) measurement. Alberti writes (author's translation): "The height of the columns, including the capitals, is equal to the distance between the farther edge of the right base to the farther edge of the left." ("Longitudo columnarum cum capitulis tanta est: quanta sit ab angulo extremo basis dextræ ad angulum extremum sinistræ.") Leonis Baptiste Alberti, *De re aedificatoria* (Florence, 1485), VII, xii, fol. riiii. By contrast, Rykwert et al.'s translation reads (brackets are the translators'): "The length of the columns, complete with capitals, should equal that of the diagonal [of the void] from bottom right to top left." Leon Battista Alberti, *On the Art of Building in Ten Books*, Joseph Rykwert, Neil Leach and Robert Tavernor, transl. (Cambridge, Mass. and London, 1988), 226. In their study of the basilica of Santo Spirito, Benevolo, Chieffi, Mezetti, et al. provide a floor plan annotated with every unobstructed plinth-to-plinth dimension in the church but never use any of them in their numerous proportional calculations. Rather, they use exclusively on center

dimensions. When considering elevation proportions, furthermore, these authors deny any architectural significance to the column plinths whatsoever. Stating that Brunelleschi considered column plinths to be merely portions of "exposed foundation" [*fondazione allo scoperto*], they set the base line for their proportional calculations at the tops of the column plinths, rather than at floor level. Leonardo Benevolo, Stefano Chieffi, Giulio Mezzetti, "Indagine sul S. Spirito di Brunelleschi," *Quaderni dell'istituto di storia dell'architettura*, XV, 85-90, 1968, p. 12, and Dis. XXVI. Scarchilli follows suit in his proportional studies of the basilica of San Lorenzo. Renzo Scarchilli, "Il complesso laurenziano: La chiesa (prima parte), *Controspazio*, IX, 1, 1977, p. 45, Fig. 3. A second part appears never to have been published. For a Vitruvian plinth-to-plinth reference, see *De architectura*, III, iii, 2.

[6] Thus 797.5 ÷ 564.0 = 1.4140, which is nearly identical to $\sqrt{2}$, or, 1.4142….

[7] A root-2 rectangle is formed by extending two parallel sides of a square to equal the length of its diagonal (see Figure 2-2, center). The resultant side/diagonal ratio is 1:$\sqrt{2}$.

[8] "…quantunque insieme e' levassono grossamente in disegno quasi tutti gli edifici di Roma, ed in molti luoghi circustanti di fuori, colle misure delle larghezze ed altezze, secondo che potevano, arbitrando, certificarsi, e longitudini, ecc. E in molti luoghi facevano cavare per vedere e riscontri de' membri degli edifice e le loro qualità, s'egli erano quadri o di quanti anguli, o tondi perfetti o ovati o di che condizione, e così, dove e' potevano congetturare, l'altezze, così da basa a basa per altezza, come da' fondamenti e riseghe e tetti degli edifici…." Antonio Manetti, *Vita di Filippo Brunelleschi*, Giuliano Tanturli, ed. (Milan, 1976), 67. Saalman nevertheless interprets Manetti's phrase "from base to base" as a reference to the significantly larger "… intercolumnal dimension measured from shaft to shaft" (i.e., in the clear). Antonio di Tuccio Manetti, *The Life of Brunelleschi*, Howard Saalman, ed. (University Park and London, 1970), 34, 52, and 132 note 33. Cf. a record of payment from 1443 for construction of a pier "from the base to the capitals," a specification that could not possibly include the base but not the plinth of the pier. Isabelle Hyman, "Fifteenth Century Florentine Studies: The Palazzo Medici; and a Ledger for the Church of San Lorenzo." PhD diss., New York University, 1968 (Ann Arbor, Michigan, 1970), 332, 464. See also *ibid*., 337, 516, 539.

[9] For a more detailed discussion of the statistical analysis used in this study, see Appendix 9.4.

[10] Isabelle Hyman, 'Fifteenth Century Florentine Studies: The Palazzo Medici; and a Ledger for the Church of San Lorenzo.' PhD diss., New York University, 1968 (Ann Arbor, Michigan: University Microfilms, Inc., 1970), pp. 349, 400-403, 496. Although these winged beings with young childrens' faces resemble cherubim, contemporary construction documents refer to them as 'seraphim' (*serafini*). *Ibid*., pp. 349, 496, 511. I refer to them as angels, however, in keeping with the

iconography of the entablature block friezes that depict the Lamb of God and the seven-sealed Book of the Apocalypse—apparent references to Revelation, which refers frequently to angels, but neither cherubim nor seraphim. Furthermore, the correspondence between the number of columns in each nave arcade, seven, and the recurrent theme of seven in the Book of Revelation, is perhaps not coincidental. See Revelation 5-10.

[11] For previous, less detailed San Lorenzo nave capital observations, see Martin Gosebruch, "Florentinische Kapitelle von Brunelleschi bis zum Tempio Malatestiano und der Eigenstil der Fruhrenaissance," *Römisches Jahrbuch für Kunstgeschichte* 8 (1958), 84-91; Howard Saalman, "Filippo Brunelleschi: Capital Studies," *Art Bulletin* 15, no. 2 (Ju. 1958), 123-127; and Gabriele Morolli, "L'ordine brunelleschiano: morfologia e proporzioni," in *San Lorenzo 393-1993*, 81-94. For other observations of discontinuities in parts of the nave other than the arcades, see: Piero Roselli, 'Brunelleschi in San Lorenzo, Contributi alla cronologia dell'edificazione,' *Antichità viva* 2, 1979, p. 38, Fig. 2; Piero Roselli and Orietta Superchi, *L'edificazione della basilica di San Lorenzo* (Florence: Cooperativa Editrice Universitaria, 1980), pp. 71-72, Figs. 10-11; and Gabriele Morolli, "San Lorenzo da Piero a Lorenzo (1465-1480 circa)," in *San Lorenzo 393-1993: L'architettura, Le vicende della fabbrica*, ed. by Gabriele Morolli and Pietro Ruschi (Florence: Alinea Editrice, 1993), p. 76.

[12] The old basilica occupied the site of the eastern four bays of the nave until about 1465 (see Chapter 5).

[13] Morolli assumes that unspecified eastern nave columns were constructed after 1465 under the patronage of Piero dei' Medici. Gabriele Morolli, "L'ordine brunelleschiano: morfologia e proporzioni," in *San Lorenzo 393-1993*, 84ff. Other scholars discuss the construction of the eastern nave chapels without mentioning the nearby columns, which need not be assumed contemporaneous with the chapels. Volker Herzner, "Zur Baugeschichte von San Lorenzo in Florenz," Zeitschrift fur Kunstgeschichte 37, 1974, 90 ff; Piero Rosselli, "Brunelleschi in San Lorenzo, Contributi alla cronologia dell'edificazione," *Antichità viva* 2 (1979), 41; repeated in Piero Roselli and Orietta Superchi*, L'edificazione della basilica di San Lorenzo….* (Florence, 1980), 24; Miranda Ferrara and Francesco Quinterio, *Michelozzo di Bartolomeo* (Florence, 1984), 204-206, 285-287; and Howard Saalman, "Capital Studies," 124 Plate III, and *Brunelleschi: The Buildings*, 188, 439 Docs. 13.1, 13.2, 14.1.

[14] In this study column shaft heights are measured from the bottoms of the plinths to the mortar joints below the astragals, which are integral with the capitals. Measuring to the tops of the astragals would make the discrepancy in question worse.

[15] A dual diagon is a rectangle formed by extending two parallel sides of a square to equal the length of its diagonal (thus forming a root-2 rectangle) and then extending those two sides again by the same amount. The resultant width-to-height ratio is 1:2√2-1. I borrow the term “dual diagon” from Kenneth J. Conant, “The After-life of Vitruvius in the Middle Ages,” *Journal of the Society of Architectural Historians* 27 (1968), 34. Conant in turn attributes the term, without references, to “investigators attached to the National Museum at Ljubljana, Yugoslavia, including Tine Kurent.” See Tine Kurent, *Kosmogram romanske bazilike v stični: Cosmogram of the Romanesque Basilica at Stična, Yugoslavia*, Univerza v Ljubljani, Fakulteta za Arhitekturo, Gradbeništvo in Geodezijo, Ljubljana, no. 2 (1977/78), 31. Neither Conant nor Kurent, however, provide verifiable measurements demonstrating the use of this figure in medieval architecture.

[16] Mathes Roriczer, *Büchlein von der Fialen Gerechtigkeit*, Regensburg, 1486. For an English translation, see: Lon R. Shelby, *Gothic Design Techniques: The Fifteenth-Century Design Booklets of Mathes Roriczer and Hanns Schmuttermayer* (Carbondale, Ill., 1977), 1, 2, 32.

[17] *Ibid.*, pp. 84–98. Frankl quotes a document of 1459 that mentions rules that prohibit members of mason’s lodges across central Europe from revealing “…how to take the elevation from the ground plan,” and from this evidence assumes that the rotation of squares technique was a “secret of the mediaeval masons” (Frankl, Paul, “The Secret of the Mediaeval Masons,” *Art Bulletin*, XXVII, 1, 1945, p. 46), an interpretation that Shelby refutes (Lon R. Shelby, “The ‘Secret’ of the Medieval Masons,” in Bert S. Hall and Delno C. West, *On Pre-Modern Technology and Science Studies in Honor of Lynn White*, Jr., Malibu, 1976, pp. 201-219.

[18] Serlio, *Il Secondo libro d’Architettura* (Paris, 1545); and Serlio, *Il Terzo Libro di Sabastian Serlio Bolognese….* (Venice, 1540).

[19] See for example, Serlio, *Regole generali di Architettura….* (Venice, 1537), Xir, IXv, Xv, XXVIIIv, Lv, LIIr.

[20] Note that in Figure 2-37, the root-2 rectangle aligns with the columns in the clear rather than plinth-to-plinth, perhaps to make the illustration easier to draw, since it forms part of an explication of one-point perspective drawing. Serlio, *Il Secondo libro*, 45r. Serlio also provides a preparatory wire-frame drawing of the portal show in Figure 2-37that contains these same proportions. For a quite different interpretation of the proportions of this illustration in Figure 2-37, which is supported neither by diagrams nor measurements, see Saalman, “Early Renaissance Architectural Theory,” 98. For Figure 2-38, see Sebastiano Serlio, *Il Terzo Libro,* XLIX.

[21] Serlio, *Il terzo libro*, LVI, LXXI.

[22] Regarding the portal in his Spoleto illustration (see Figure 2-40), Serlio concedes, "… I did not measure it, but from horseback I designed its conception and form." ("… non la misurai, ma cosi a cavallo disegnai la invenzione, e la forma"). Serlio, *Il Terzo Libro*, LVI. For his drawing of the Spello city gate (see Figure 2-41), Serlio provides his ground plan measurements but then similarly notes: "the heights I did not measure: rather, I invented them completely in the drawing, because I liked them" ("le altezze io non le misurai, ma tolsi la inventione solamente in disegno, perche mi piacque."). Serlio, *Il Terzo Libro*, LXXI.

[23] "In width and length, atriums are designed according to three classes. The first is laid out by dividing the length into five parts and giving three parts to the width; the second, by dividing it into three parts and assigning two parts to the width; the third, by using the width to describe a square figure with equal sides, drawing a diagonal line in this square, and giving the atrium the length of this diagonal line." Vitruvius, *The Ten Books on Architecture*, transl. Morris Hicky Morgan, New York, 1960 (rpt. Cambridge, Massachusetts, 1914), VI, iii, 3; p. 177; "Atriorum vero latitudines ac longitudines tribus generibus formantur. Et primum genus distribuitur, uti, longitudo cum in quinque partes divisa fuerit, tres partes latitudini dentur; alterum, cum in tres partes dividatur, duae partes latitudini tribuantur; tertium, uti latitudo in quadrato paribus lateribus describatur inque eo quadrato diagonius linea ducatur, et quantum spatium habuerit ea linea diagonii, tanta longitudo atrio detur." Vitruvius, *On Architecture*, The Loeb Classical Library, E. H. Warmington (ed.), Cambridge, Massachusetts and London, 1985, VI, iii, 3; p. 26.

[24] Carol Herselle Krinsky, "Seventy-Eight Vitruvius Manuscripts," *Journal of the Warburg and Courtauld Institutes*, 30, 1967, p. 38, notes 33 and 36. Umberto Eco notes that "from the ninth century onwards, Vitruvius was constantly cited in philosophical and technical manuals alike." Umberto Eco, *Art and Beauty in the Middle* Ages, trans. Hugh Bredin (New Haven: Yale University Press, 1986), 29.

[25] "Doors can be rectangular and they can also be half-round [i.e., semi-circular arched]. But the ancients used mainly rectangular, and in private buildings one never sees any but rectangular. It is true that in city gates such as those that are in Rome they are all round [i.e., semi-circular arched]. The measure of the portals are of three orders [*ragioni*]…of the three orders that pertain to the portals, that is, the width in relation to the height, I will tell you the form; as I said they can be of three orders of measure, as are also the columns or other members aforementioned, and these depend on the place where they are made, so the measures they require depend on the place; and they are made according to two squares, according to one and a half, and according to one and the diameter [i.e., diagonal]; and these are the three orders of measure. Like this the arched ones [i.e., semi-

circular arched portals] also have these same three orders of measure, that is, Doric, Ionic, and Corinthian, that is, according to one square and a half, and according to one square and the diameter, and according to two squares, the diameter you having already seen how to take from the square…" (author's translation); "Le porti possono ess(er)e quadre & anche possono ess(er)e mezze tonde Ma pure gliantichi lusauano lamaggiore parte quadre & nelli hedificij priuati no(n)ne uidi mai senon quadre. Vero e che importe dicitta come chesono a Roma sono tonde tutte. Lamisura delle porti sono ditre ragioni….alle ragioni cheuogliono ess(er)e leporti cioe lalarghezza alla altezza uidiro laforma come o detto possono ess(er)e ditre ragioni dimisure come sono ancora lecolonne o altri menbri antedetti & queste ancora seco(n)do eluoghi doue sifanno chesecondo illuogho cosi richiegghono lamisura & fannosi adue quadri – auno & mezzo – auono diamitro & cosi sono ditre ragioni dimisure cosi gliarchi ancora anno queste medesime ragioni dimisure cioe /dorico/ ionico & corintho cioe auno quadro & mezzo & auno quadro diamitro & adue quadri il diamitro che auete inteso dinanzi come sipiglia dalquadro…", transcription from Biblioteca Nazionale, Florence, MS II, I, 140 (formerly Cod. Magliab. XVII, I, 30) by Howard Saalman in: "Early Renaissance Architectural Theory and Practice in Antonio Filarete's *Trattato di Architettura*," *Art Bulletin*, XLI, 1, 1959, p. 91, n. 1 and 5.

Saalman has, I believe, misinterpreted the last portion of this passage when he claims it to be a description of a rectangle derived from the diagonal of two squares, or, a root-5 rectangle, which has the proportions 1:√5. According to Saalman, "*A due quadri il diamitro* is √5:1, the diagonal of a 2:1 rectangle to the shorter side." (Saalman, 1959, p. 92). Filarete clearly states that the arched portals he describes have the "same orders of measure" ("medesime ragioni dimisure") as the rectangular doorways that he describes earlier in the passage, and he names these "orders of measure" after the three orders of columns that he recognized: Doric (square and a half), Ionic (root-2 rectangle), and Corinthian (double square). Filarete thus makes clear his intention that the same three "orders of measure" be used both for rectangular doorways and arched portals. Saalman's introduction of a new, fourth "order"—a root-5 rectangle—into Filarete's arched portal proportions would therefore seem to be mistaken. Saalman's apparent error perhaps derives from his reading of the words "adue quadri il diamitro" as a verbal unit (Saalman, 1959, p. 92), and from his translation of this unit as: "the diameter of two squares" (Saalman, 1959, p. 91). Note that in the last portion of my translation above: "…according to one square and a half, and according to one square and the diameter, and according to two squares, the diameter [noted here] you having already seen how to take from the square…," I have used a comma to separate the words "two squares" from "the diameter [i.e., diagonal]," so that "two squares" and "diameter" will *not* be read as a verbal unit.

Thus the word "diameter" can only refer to Filarete's last usage of it, which is in the phrase "one square and the diameter." My insertion of a comma in this location is consistent with the Finoli and Grassi edition (Antonio Averlino detto il Filarete, *Trattato di Architettura*, Anna Maria Finoli and Liliana Grassi, eds., Milan, 1972, p. 233).

[26] For doorway proportions see Orlandi, I, xii, pp. 84-84; and for arcade and colonnade bay proportions of 1 : 3 1/2, 1 : 1 1/3, 1:2 and 1: 1/3 see *ibid*, VII, xv p. 643.

[27] These proportions may be summarized as follows: for floor plans, 1:1, 3:4, 2:3, 3:5, 1:2; and for room heights: 2:5, 1:3, 1:4, 1:5, and 1:√2. The full array of Martini's room proportions breaks down as follows: *Atrio* and *sale* (floor plans: 3:5, 2:3, circle; heights: 1:3, 1:4, 1:5, 1:√2, 1:2, 2:5), *cortili* (1:1, 1:1 1/3, 1:1 1/2, 1:1 2/3), *camere* (floor plans: 1:1, 1:1 1/3, 1:1 1/2; heights: 1:√2), *salotti* (floor plans: 1:2, 1:1 2/3, 1:1 1/2; heights: 1:√2 or "*del solaro*"), *altri salotti o teclini* (floor plans: 1:1, 1:1 1/3, 1:1 1/2, 1:1 2/3; heights: 1:√2), *cucina* (2:3, 1:1 2/3). Francesco di Giorgio Martini, *Trattati di architettura, ingegneria e arte militare*, Corrado Maltese and Livia Maltese Degrassi, eds., 2 vols., Milan, 1967 (hereafter Maltese), vol. 2, pp. 345–347, and tav. 194. Francesco describes the proportion 1:√2 as follows: "…one makes a square from the width [of the room], and divides it with a diagonal line from corner to corner, and this diagonal is the height." (author's translation); "…si facci uno quadrato della larghezza overo latitudine, e dividisi per linea diagonia da angulo ad angulo, e quello diametro sia l'altezza." (Maltese, p. 345). I have omitted from consideration a few of Francesco's more complex constructions, such as a rectangle composed of two side-by-side root-5 rectangles (see Maltese, pp. 347, 349 and tav. 195, 203, 204).

[28] Carlo Pedretti, "Newly Discovered Evidence of Leonardo's Association with Bramante," *Journal of the Society of Architectural Historians*, XXXI, 3, 1973, pp. 223–227.

[29] Aristotle, *The Physics*, Philip H. Wicksteed and Francis M. Cornford, transl., Cambridge, Massachusetts and London, 1996, IV, xi, 219b3–9; cited in Judith V. Field, "Kepler's Rejection of Numerology," *Occult and Scientific Mentalities in the Renaissance*, Ed. Brian Vickers, Cambridge, 1984, pp. 274, and 293 n. 7.

[30] Johannes Kepler, *Narratio de observatis a se quatuor Iovis satellitibus erronibus* (Frankfurt, 1611) in Kepler, *Gesammelte Werke*, ed. W. von Dyck, M. Caspar, F. Hammer, et. al. (Munich, 1938?), IV, 370, II, 19–25, cited in Field, *ibid.*, pp. 274, 293 n. 5.

[31] The *campione* is a brass bar made in 1782 on the orders of Pietro Leopoldo to serve as the standard measure for all of Tuscany. Its length was based on the Florentine *braccio* in use at the time, which was believed to be the same as that used "since ancient times" (*dall'antica*). *Tavole di ragguaglio per la riduzione dei pesi e misure….* (Florence, 1782), xvi. In 1808 this *campione* was precisely

measured to establish the official metric length of the *braccio* at 0.583625839 m. *Tavole di riduzione delle misure e pesi….* (Florence, 1809), 11-12. This measurement became the basis for the metric value of the Florentine *braccio* listed in numerous late nineteenth-century metric conversion tables, most notably Angelo Martini, *Manuale di metrologia* (Turin, 1883), 206. It is consistent with my measurement of this *campione*, 116.73 cm (or, 1 *braccio* = 0.58365 m); that of a drawn *campione*, c. 1500, measured by Burns; and the "average" *braccio* calculated by Zervas based on a variety of sources, though the only reliable source contained within that average is the 1782 *campione*. Howard Burns, "San Lorenzo in Florence Before the Building of the New Sacristy: An Early Plan," *Mitteilungen des Kunsthistorischen Institutes in Florenz* 23, no. ½ (1979), 145; and Diane Finiello Zervas, "The Florentine Braccio da Panna," *Architectura* , no. 1 (1979), 6-10. Most significantly, the length of the 1782 *passetto* corresponds with great precision to the widths of the San Lorenzo column plinths (Figure 2-44).

[32] According to the Florentine mathematician Pier Maria Calandri (1419-1467): "Linear measure is used for cloth, drapes and other similar things; this measure is only by length, and the main instrument used in Florence is the *canna* which is divided into four parts, each called a *braccio*; but the *braccio* has no parts other than those taken of itself, such as $\frac{1}{2}$ *braccio* and $\frac{1}{3}$ *braccio*, an eighth of a *braccio*, and so on" ("… ma il bracco non à divisione alcuna se none le parti che se ne piglia, come a dire 1/2 bracco et 1/3 di bracco et ottavo di bracco et simili parti.)" Pier Maria Calandri, *Tractato d'Abbacho, dal Codice Acq. e doni 154 [sec. XV] della Biblioteca Medicea Laurenziana di Firenze,* Gino Arrighi, ed. (Pisa, 1974), 32-33. For a nearly identical statement in a similar *trattato* of 1463 by Lionardo Pisano, see Gino Arrighi, "Il codice L.IV.21 della biblioteca degl'intronati di Siena e la 'bottega dell'abaco a Santa Trinita' in Firenze," *Physis* 7, fasc. 4 (1965), 386. Note that in the San Lorenzo "Venice plan," c. 1500, annotated *braccio* dimensions include only fractional subdivisions while the "Chatworth plan", c. 1550, contains *braccio* annotations with subdivisions in *soldi* and *denari*. Burns, "San Lorenzo in Florence," Figures 1, 2, 4. See also the San Lorenzo construction ledger (1441-1453), in which *braccio* subdivisions are expressed only as fractions. Hyman, *Fifteenth Century Florentine Studies*, Part II.

[33] The centimeter measurements noted here are approximate because they reflect bay-by-bay variations. Other notable *braccio* dimensions include the column and pilaster plinth widths, 2 br (approximately 2.001 cm); the column and pilaster shaft diameters, 1 ½ br (approximately 1.494 cm); and the archivolt widths in elevation, also 1 ½ br (approximately 1.513 cm).

[34] Aspects of Boethian number theory survive in the obscure field of modern number theory. See, for example: Leonardo Eugene Dickson, *History of the Theory of Numbers*, II, Washington, 1920. Historians of mathematics tend to emphasize the mathematically rudimentary level of Boethius's writings on arithmetic, and to downplay the importance of these writins in the development of medieval thought. See for example, Boyer and Merzbach's comment: "…[Boethius] was concerned primarily with two aspects of mathematics: its relationship to philosophy and its applicability to simple problems of mensuration. Of mathematics as a logical structure there is little trace"; and later, their reference to "the jejune Latin texts of Boethius." Carl B. Boyer, *A History of Mathematics*, 2nd ed., revised by Uta C. Merzbach, New York, 1991, pp. 191f, 193-194. See also Ifrah's comment: "'Theoretical' arithmetic in the High Middle Ages was drawn from a work attributed to the Latin mathematician Boethius…who had himself drawn handsomely on a second-rate work by the Greek Nicomacchus of Gerasa…. As for 'practical' arithmetic, it consisted mainly in the use of Roman numerals, and in operations with counters on the old abacus of the Romans; it also included the techniques of finger-counting transmitted by Isodore of Seville…." Georges Ifrah, *The Universal History of Numbers*, New York, 2000, p. 578. Beseler and Roggenkamp's efforts to link measurements of St. Michael's Church in Hildesheim to Boethian number theory has several shortcomings, including unrigorous use of unverifiable measurements (which may in fact be estimated measurements), and a limited reading of Boethius's *De arithmetica*. Hartwig Beseler and Hans Roggenkamp, *Die Michaeliskirche in Hildesheim*, Berlin, 1954, pp. 134ff.

[35] For general works on Boethius, see: Pierre Courcelle, *Late Latin Writers and Their Greek Sources*, Harry E. Wedeck, transl., Cambridge, Massachusetts, 1969, pp. 273-330; Lorenzo Minio-Paluello, "Anicius Manlius Severinus Boethius," *Dictionary of Scientific Biography*, II, New York, 1970, pp. 228-236; Howard Rollin Patch, *The Tradition of Boethius: A Study of His Importance in Medieval Culture*, New York, 1935; Edward Kennard Rand, *Founders of the Middle Ages*, Cambridge, Massachusetts, 1928, pp. 135-180; and William H. Stahl, *Roman Science: Origins, Development, and Influence to the Later Middle Ages*, Madison, 1962, pp. 193-211.

[36] Edward Kennard Rand, as paraphrased in: André Barbera, "Interpreting an Arithmetical Error in Boethius's De Institutione musica (iii. 14-16)", *Archives internationales d'Histoire des Sciences*, Vol. 31, No. 109, 1981, p. 26.

[37] *Paradiso*, X, 125.

[38] *The Book of Saints*, 4th ed., London, 1947, p. 536; According to Turner: "The local cult of Boethius at Pavia was sanctioned when, in 1883, the Sacred Congregation of Rites confirmed the custom prevailing in that diocese of honouring St. Severinus Boethius, on the 23rd of October."

William Turner, “Anicius Manlius, Severinus Boethius,” *The Catholic Encyclopedia, II*, New York, 1907, Online Edition, 2002, <http://www.newadvent.org/cathen/02610b.htm> (accessed February 16, 2003).

[39] Nicomachus of Gerasa, *Introduction to Arithmetic*, Martin Luther D'Ooge, transl. (New York and London, 1926); Anicii Manlii Torquati Severini Boetii, *De institutione arithmetica, libri duo, de institutione musica, libri quinque*, Godofredus Friedlein, ed. (Leipzig, 1867); and Michael Masi, *Boethian Number Theory: A Translation of the De Institutione Arithmetica* (Amsterdam, 1983).

[40] For the estimated date of completion of *De institutione arithmetica*, see C. J. De Vogel, “Boethiana I,” *Vivarium* 9, no. 1 (May 1971), 65; and Edmund Reiss, *Boethius* (Boston, 1982), 11. Gregor Reisch, *Margarita philosophica*, (Freiburg, 1503), Book IV, title page. The illustration reflects an historical misconception common during the Renaissance and later periods that itself attests to the high regard in which Boethius was held. Pullan notes: “It has been said that Boethius first showed the Arabic system [of numeration] to the western world, just as Pythagoras is said to have introduced the abacus into Greece nearly 1000 years before.” But, he continues, “Boethius’s part is dubious,” since Arabic figures first appear in European manuscripts in the 10th century, and were probably not used for calculation until much later. J. M. Pullan, *The History of the Abacus*, (New York and Washington, D.C., 1968), 36. On this illustration see also Karl Menninger, *Number Words and Number Symbols* (Cambridge, Mass., 1969), 350, 431; and Masi, *Boethian Number Theory*, 19ff. On the original date of publication of *Margarita Philosophica*, see John J. Bateman, “The Art of Rhetoric in Gregor Reisch's Margarita Philosophica and Conrad Celtes' Epitome of the Two Rhetorics of Cicero,” *Illinois Classical Studies* 8, no. 1, 1983, pp. 137 notes 1-2.

[41] For example, the Lombard duke Filippo Maria Visconti (r. 1412–47) had two copies in his palace library in Pavia and Coluccio Salutati owned one in Florence. *Indagini storiche, artistiche e bibliografiche sulla libreria visconteo-sforzesca del castello di Pavia* (Milan, 1875), 50, 95; Marina Passalacqua and Lesley Smith, eds., *Codices Boethiani: A Conspectus of Manuscripts of the Works of Boethius*, 3 vols. (London and Turin, 2001), III: 85. On “the truly fundamental nature of Boethian mathematics in medieval number theory,” see Michael Masi, “The Influence of Boethius’ *De arithmetica* on Late Medieval Mathematics” in *Boethius and the Liberal Arts: A Collection of Essays*, ed. Masi (Bern, 1981), 95 and references therein.

[42] For Boethius, the highest intellectual pursuit is philosophy, which must be approached through sequential study of arithmetic, music, geometry, and astronomy, or, the *quadrivium*, a term he coins here. *De institutione arithmetica*, I, 1; and Masi, *Boethian Number Theory*, 71-74. See also Pearl Kilbre, “The Boethian De Institutione Arithmetica and the Quadrivium in the Thirteenth Century

University Milieu at Paris," in *Boethius and the Liberal Arts: A Collection of Essays*, Michael Masi, ed. (Bern, Frankfurt, and Las Vegas, 1981), 67.

[43] *De Arithmetica*, II, 4; Masi, *Boethian Number Theory*, p. 128.

[44] Such numbers are distinct from others because, Boethius tells us, they concern "…that quantity which consists of itself; it is not referred to anything else…." Boethius, II, 4 (Masi, *ibid.*, p. 128). Thus, they may be considered the building blocks of more complex construction in Boethian number theory. Nicomachus calls the geometrical numbers "absolute" numbers. Nicomachus, VI, I (Nicomachus of Gerasa, *Introduction to Arithmetic*, Martin Luther D'Ooge, transl., with Studies in Greek Arithmetic by Frank Egleston Robbins and Louis Charles Karpinski, New York and London, 1926, p. 236).

[45] Boethius calls them "figured numbers" (*figuratis numeris*). *De Arithmetica*, II, 18; Masi, *Boethian Number Theory*, p. 141; and Nicomachus calls them "polygonals," the more descriptive term that I will adopt. Nicomachus, II, XII, 4; D'Ooge, *ibid.* p. 248.

[46] Boethius notes that conventional numerals, by which he means Roman numerals, are not "formed by natural institution," but rather, "by custom," and so he describes numbers as sets of "strokes" (*virgulas*) so that the magnitudes they denote are manifest. *De Arithmetica*, II, 4; Masi, *Boethian Number Theory*, pp. 128-129; cf. Nicomacchus, II, vi, 2; D'Ooge, ibid., p. 237.

[47] Regarding unity Boethius notes: "…unity has the potential of a point, the beginning of interval and longitude; it is not itself capable of interval or longitude, just as the point is the beginning of the line and the interval, although it is itself neither interval nor line. Nor does a point put upon a point bring about an interval, any more than if you joined nothing to nothing. It is nothing and nothing comes from nothing. The same proportionality exists between equalities. Now if there were equal terms, so much it is from the first to the second as from the second to the third, and between first and second, or second and third, there is no quantity of interval or space." Masi, *Boethian Number Theory*, p. 129; *De Arithmetica*, II, 4, p. 87. On the possible symbolic significance of unity, see the discussion of symbolic numbers, below.

[48] *Liber Mathematicalis Bernwardi*, Domschatz Nr. 31, Hildesheim. For catalogue information see Victor H. Elbern and Hans Reuther, *Der Hildesheimer Domschatz*, (Hildesheim, 1969), 43-44; and Helmar Härtel and Marlis Stähli, *Die Handschriften im Domschatz zu Hildesheim* (Wiesbaden, 1984), 71-73.

[49] Boethius, *De institutione arithmetica*, II, 4, 14-16; Masi, *Boethian Number Theory*, 129, 137-139. Nicomachus of Gerasa, *Introduction*, 245, 246; Sir Thomas Heath, *A History of Greek Mathematics*,

2 vols. (Oxford, 1921), 1:77-79; and Leonardo Eugene Dickson, *History of the Theory of Numbers*, 3 vols. (Washington, D. C., 1910-1923), 2:1.

[50] Boethius writes of this progression: "Now in a hexagon we join [numbers] together with three between [each], and they surpass each other by four, and these will be the roots and foundations from which, when they are joined together, all hexagons are born: 1 5 9 13 17 21 and so on, according to that order." *De institutione arithmetica*, II, 15; and Masi, *Boethian Number Theory*, 138.

[51] The 1463 *trattato* of Lionardo Pisano repeatedly refers to Boethius and quotes extensively from *De institutione arithmetica*. Arrighi, "Il codice L.IV.21," 379-381, 382, 385. Stornaloco provides a sketch showing a series of triangles superimposed over a cross-section cathedral diagram, with the following explanation: "The triangles begin with one *unitas* [unity] according to the nature of triangles. For, once the *unitas* has been established, we have a potential triangle, and when we add a second one above it we shall have the first actual triangle." Stornaloco, trans. in Paul Frankl, "The Secret of the Mediaeval Masons," *Art Bulletin* 27, no. 1 (Mar. 1945), 53. Boethius's description of triangular numbers is strikingly similar: "The first triangle which is born from unity, as here, is a triangle in power, but not in act and operation. This power is, as it were, the mother of all numbers; whatever else occurs in the following numbers comes from that unity and it is found to be of those numbers. It is necessary that unity contains those numbers by a certain natural potency. The number three, which is the first triangle in operation and act, has the binary number [i.e., two] as a side, in growing by a unity." *De institutione aithmetica*, II, 8; and Masi, *Boethian Number Theory*, 134. Cf. Alberti's description of cubic numbers. *De re aedificatoria*, IX, vi. On the chess-like rithmomachia board, black pieces in the back row are numbered 25, 81, 169, 189. To derive them, according to a sixteenth-century rule book, one takes the number 5, and every fourth number thereafter "… which numbers will be these: 5, 9, 13, 17, and multiply said numbers by themselves…." Francesco Barozzi, *Il nobilissimo et antiquissimo giuoco pythagoreo nominato rythmomachia, cioe: battaglia de consonantie de numeri* (Venice, 1572), 6v and 7r. In the late fifteenth and sixteenth centuries, editions of Boethius's *De institutione arithmetica* were often published in the same bound volumes as *rithmomachia* rule books. For examples see David Eugene Smith, *Rara Arithmetica* (Boston and London, 1908), 62ff. See also David Eugene Smith and Clara C. Eaton, "Rithmomachia, the Great Medieval Number Game," *American Mathematical Monthly* 18, no. 4 (April 1911), 73-80; and Gillian R. Evans, "The Rithmomachia: A Mediaeval Mathematical Teaching Aid?," *Janus* 63, no. 4 (1976), 257-273.

[52] Vitruvius, *De architectura*, IX, Preface, 4.

[53] "… la quale e inrationabile, ne si trova proportione alcuna dal quadro perfetto a questo cressimento." Sebastiano Serlio, *Il primo libro d'architettura*, (Paris, 1545), 21r.

[54] For example, describing a figure of two rotated squares, Frankl notes: "The proportion of the side of the small square to that of the bigger one is 1:√2, an irrational proportion which could not be calculated by arithmetic in mediaeval times and had to be constructed by geometry." Frankl, "The Secret of the Mediaeval Masons," 51. Cf. Saalman, "Early Renaissance Architectural Theory," 93, 95. Other evidence, however, suggests that both square root calculation and the Pythagorean theorem were widely taught from at least the thirteenth century in Europe. See E.G.R. Waters, "A Thirteenth Century Algorism in French Verse," Isis 11, no. 35 (Sept. 1928), 45-84; and Paolo dell' Abbaco, *Trattato d'aritmetica, Secondo la lezione del Codice Magliabechiano XI, 86 della Biblioteca Nazionale di Firenze*, Gino Arrighi, ed. (Pisa, 1964), especially problems 148-150.

[55] Wittkower, "Systems of Proportion," *Architect's Yearbook* 5 (1953), 16; repeated in: Wittkower, *Architectural Principles* (1971), 158; and Wittkower, "The Changing Concept of Proportion," in *Idea and Image: Studies in the Italian Renaissance* (London, 1978), 116.

[56] This statement is not contingent upon the final resolution of the problem posed by the 11-12 cm column shaft height discrepancy noted above, because in any case the ratio $9\frac{2}{3} : 13\frac{2}{3}$ very accurately describes the *actual* distances between the nearer edges of any two adjacent column plinths and the farther edges of the same plinths.

[57] Equally remarkable is the numerical ratio $9\frac{2}{3} : 17\frac{2}{3}$, which accurately approximates the irrational proportions of the dual diagon. See note 16.

[58] O. Neugebauer, *The Exact Sciences in Antiquity* (New York, 1969), 35; Leonardo Dickson, *History of the Theory of Numbers*, 2:341; Plato, *Republic*, Book 8, 546C; Heath, *A History of Greek Mathematics*, 1: 93; James Gow, *A Short History of Greek Mathematics* (New York, 1923), 96 note 3; and Théon de Smyrne, *Philosophe platonicien exposition des connaissances mathématiques utiles pour la lecture de Platon*, J. Dupuis, transl. (Paris, 1892), 71–75. On Theon's formula see Gow, *ibid.*, 95-96; Heath, *ibid.*, 92; and Peter Kidson, "A Metrological Investigation," *Journal of the Warburg and Courtauld Institutes* 53 (1990), 71-97.

[59] Paul Oskar Kristeller, *Iter Italicum: A Finding List of Uncatalogued or Incompletely Catalogued Humanistic Manuscripts of the Renaissance in Italian and Other Libraries* (London, 1967), 2:368. I thank Howard Burns for calling this source to my attention (Kristeller). Theon's treatise, which was written in Greek, could have arrived in Florence at the end of the fourteenth century, when the

Ottoman Turks encroached into Byzantine territory, and Greek-speaking men of learning took refuge in Italy. Among them was Manuel Chrysoloras, who was invited to Florence in 1396 to give public instruction in Greek. Ferdinand Schevill, *History of Florence, from the Founding of the City through the Renaissance* (New York, 1936), 320; and Paul Lawrence Rose, "Humanist Culture and Renaissance Mathematics," *Studies in the Renaissance* 20 (1973), 53-54. One of Chrysoloras's students, Ambrogio Traversari (1386-1439), a promoter of Greek learning in his Camaldolese monastery in Florence, very likely served, in about 1434, as Brunelleschi's patron for the Scolari Oratory of Santa Maria degli Angeli. For many years prior to 1431 Florentine intellectuals, including two who would develop close ties to Brunelleschi, Cosimo de' Medici and Paolo dal Pozzo Toscanelli, regularly gathered in Traversari's cell as an informal academy devoted to the study of ancient Greek and Roman texts. Charles Stinger, "Ambrogio Traversari and the 'Tempio degli Scolari' at S. Maria degli Angeli in Florence," in *Essays Presented to Myron P. Gilmore*, 2 vols., S. Bertelli and G. Ramakus, eds. (Florence, 1978), 1:280-281; and Rose, "Humanist Culture and Renaissance Mathematics," 48 ff. On Chrysoloras see also Giuseppe Cammelli, *Manuele Crisolora* (Florence: Vallechi, 1941). Thus Brunelleschi, whether or not he designed the San Lorenzo set of proportions, could have had access to the mathematical knowledge needed to understand and appreciate the side/diagonal approximations embedded in it.

[60] Theon's formula may be described algebraically as: $d = 2s^2 \pm 1$. Gow, *A Short History of Greek Mathematics*, 95–96. The ratio 5:7 occurs as a side/diagonal approximation in the late Gothic mason's manual of Lorenz Lechler. Lon R Shelby and Robert Mark, "Late Gothic Structural Design in the 'Instructions' of Lorenz Lechler," *Architectura* 9, no. 2 (1979), 127-128 and Figure 4 therein. Cesariano notes the side/diagonal approximations of 5:7 and 12:17. Cesare Cesariano, *Di Lucio Vitruvio Pollione de architectura libri decem traducti de latino in vulgare* (Como, 1521; New York, 1968), 98r. The latter approximation also appears to have circulated among mathematicians of 11th century France. Paul Tannery, *Memoires Scientifiques*, V, Paris and Toulouse, 1922, p. 236.

[61] On the introduction of Hindu-Arabic numerals see Walter William Rouse Ball, *A Short Account of the History of Mathematics*, 3rd ed. (London, 1901), 192-193; D. J. Struik, "The Prohibition of the use of Arabic numerals in Florence," *Archives internationales d'histoire des sciences* 21, no. 84-85 (1968), 291-294; Gillian R. Evans, "From Abacus to Algorism: Theory and Practice in Medieval Arithmetic," *The British Journal for the History of Science* 10, no. 35 (1977), 115; and D. J. Struik, ed., *A Source Book in Mathematics, 1200-1800* (Cambridge, Mass., 1969), 1.

[62] Paolo dell' Abbaco, *Trattato d'aritmetica*. Paolo was born into the prominent Dagomari family of Prato, served as one of the *priori* in his adoptive Florence in 1363, was quoted by Boccaccio, lived

past ninety, and became one of the most esteemed mathematicians of his time. Arrighi, Introduction to Paolo dell'Abbaco, *Trattato d'aritmetica*, 7ff; which supersedes Gustavo Uzielli, *La vita e i tempi di Paolo dal Pozzo Toscanelli* (Rome, 1894), 19 ff. According to Rose, "Paolo is quoted in Boccaccio's humanist work *De genealogia deorum*, and was well known in humanist circles at Florence." Paul Lawrence Rose, "Humanist Culture and Renaissance Mathematics," *Studies in the Renaissance* 20 (1973), 58. He probably completed his *Trattato* near his death in 1374, judging from internal evidence in word problems that involve hypothetical situations placed in the years 1372 to 1374. Paolo dell'Abbaco, *Trattato*, Problems 112 and 113, pp. 93-95. On the date of Paolo's death, see Arrighi, *ibid.*, 7. The manuscript published by Arrighi dates from the fifteenth century, thus evidencing the continued topicality of the work in the decades following Paolo's death. Among those who attended Paolo's school was the doctor, mathematician, and younger friend of Brunelleschi, Paolo dal Pozzo Toscanelli. Arrighi, Introduction to Paolo dell'Abbaco, *Trattato d'aritmetica* 7-13.

[63] The extensive use of fractions in Paolo dell'Abbaco's *Trattato d'aritmetica*, many of which contain large numerators and denominators, calls into question Carpo's claims that "the unavailability of general fractions confronted classical [i.e., Renaissance] architectural writers with many dumfounding problems," and that "…the only fractions available at the time were unit fractions: fractions in the format '1/n,' all numerators being equal to one." Mario Carpo, "Drawing with Numbers: Geometry and Numeracy in Early Modern Architectural Design," *Journal of the Society of Architectural Historians* 62, no. 4 (Dec. 2003), 451, 456-457.

[64] Calandri, *Tractato d'Abbacho*, 61.

[65] The last step in Paolo's solutions to his word problems 148-150 require the following calculations, respectively: 49:196 => $\frac{49:196}{5} = 9\frac{4}{5} : 39\frac{1}{5}$; 49:441 => $\frac{49:441}{10} = 4\frac{9}{10} : 44\frac{1}{10}$; and 49:784 => $\frac{49:784}{17} = 2\frac{5}{17} : 46\frac{2}{17}$. Paolo dell'Abbaco, *Trattato*, 120-122.

[66] The interest in reconciling mathematically irrational, geometrically-derived proportions with numbers, evident in the San Lorenzo set of proportions, would seem consistent with certain late medieval intellectual constructs such as the *coincidentia oppositorum*, formulated by the philosopher Nicholas of Cusa (c. 1401–1464), and presented in his influential treatise *De docta ignorantia*, completed in 1440. For Nicholas, opposites in nature or philosophy, such as the infinitely large and the infinitely small, are united because both represent "absolute maximum," a concept that for him can be embodied only by God. Joseph E. Hofmann, "Nicholas Cusa," *Dictionary of Scientific Biography* 3 (New York, 1971), 514. Nicholas was once a classmate in Padua of Brunelleschi's long-

time acquaintance, Paolo dal Pozzo Toscanelli. Uzielli, *La vita e I tempi*, 67; and Manetti, *Vita*, Tanturli, ed., 70 note 3, and 93 note 23.

[67] In this study, when no simple fractional equivalent is implied, remainders are expressed in modern English decimal notation, a form that first appeared in 1616. Carl B. Boyer, *A History of Mathematics*, 2nd ed., revised by Uta C. Merzbach (New York, 1991), 317.

[68] Also note that the ratio between these two heights, $1\frac{2}{3} : 2\frac{1}{3}$, is equivalent to 5:7, which is one of the side/diagonal approximation pairs generated by Theon of Smyrna's formula (see Figure 2-49).

[69] Note that this finding contradicts the assumption and findings of Benevolo *et al*. (see note 4).

[70] Manetti accuses those who built at variance with Brunelleschi's intentions of having, variously (page numbers refer to Manetti, *Vita*, Tanturli, ed.), "ignorance," 99, 114, 115, 117; "presumption," 99, 110; "arrogance," 100; and "malice," 117; of "believing himself to be an expert," 105; and of "having a sly temperament that does everything wickedly," 112.

[71] Manetti, *Vita*, Tanturli, ed., 117.

[72] *Ibid*., 116–117.

[73] *Ibid*., 99-100.

[74] *Ibid*., 101.

[75] Antonio Billi, *Il libro di Antonio Billi*, Fabio Benedettucci, ed. (Rome, 1991), 33-34. On Della Luna's role at the Ospedale, see Saalman, *Filippo Brunelleschi: The Buildings*, 49ff. Since Billi claims Brunelleschi's trip to Milan took place during the construction of the portico of the Ospedale degli Innocenti, it can be placed in or around 1420, the year in which Filippo Maria Visconti offered a peace treaty to Florence. Hans Baron, *The Crisis of the Early Renaissance* (Princeton, New Jersey, 1966), 371. Manetti simply notes that during construction of the Ospedale Brunelleschi had to be "elsewhere for a time." Manetti, *Vita*, Tanturli, ed., 100.

[76] On 8 November 1428, Giovanni de' Medici endowed two new canonries in the church of San Lorenzo, one dedicated to Saints Cosmas and Damiano to which the chapel is dedicated, and the other to Saint John the Evangelist, to which the Old Sacristy is dedicated. Moreni, *Continuazione*, 2:361–368. The endowment was finalized in a meeting held in the Old Sacristy, which the document describes as "sumptuous and newly built." A similar *ricordo* is quoted in *Donatello e la Sagrestia Vecchia*, 102; and Ruschi, "Una collaborazione interrotta," 85 note 7. These documents are consistent with the date "1428" carved into the original lantern cap of the Old Sacristy, today displayed on the cloister balcony. Additional evidence that the double chapel and Old Sacristy were completed as a unit is the exterior terra cotta frieze that circumscribes these two, but no other, parts

of the basilica. Carlo Sisi, "Due interventi di restauro sulle decorazioni in terracotta della Sagrestia Vecchia," in *Donatello e la Sagrestia Vecchia*, 86-99.

[77] Of the three components that make up the entablature, the architrave and cornice are carved from *pietra serena*, while the frieze is simply a blank area of stuccoed wall. Thus, even if Brunelleschi had left correctly dimensioned samples of the architrave and cornice, the *capomaestro* would have had to have known the correct frieze height.

3. Sets of Proportions in the Overall Basilica of San Lorenzo (including the Old Sacristy)

Unlike the nave arcades, which are composed of clearly defined, essentially two-dimensional repeating bays that are conducive to proportional analysis, the basilica as a whole at first appears to lack overall proportional order. The body of the basilica consists of a jumble of chapels of different shapes and sizes, two non-identical sacristies, and an assembly of zigzagging exterior walls that, taken together, are more suggestive of haphazard accretion than comprehensive design (see Figure 2-1). Indeed, Manetti's warning that "...to judge [this work] as Filippo's would be to judge falsely, because his greatness is not in it" would seem to imply that some problem of execution impeded realization of a single vision.[1] An overall basilica set of proportions comes to light, however, with a slight methodological modification.

3.1 Methodology

Since the most important dimensions of the overall basilica are not repetitious, we can no longer insist that to be considered intentional, a proportion must correspond to the measurements within statistically established tolerances. In the nave arcade bays, for example, a discrepancy of more than 2 cm between a proportional relationship under consideration and the actual measurements was cause for concern, because statistics established that masons built the nave arcade bays within that degree of accuracy (at least in the earlier phase of nave construction). With regard to the overall basilica, however, we have no way to determine how large a discrepancy between a particular proportion and the actual measurements warrants concern. Consequently, a different approach to the overall basilica is needed. In the analysis that follows, we will round off dimensional irregularities more freely than before in search of evidence of proportional logic resembling that of the nave arcade bay set of proportions. Consistent with the Part I methodology, historical explanations will be provided for the rounded-off dimensions, and virtually every centimeter will be accounted for in the end.

3.2 Proportional Building Blocks

This strategy of temporarily rounding off dimensions makes possible an important observation: while the basilica floor plan lacks *dimensional* modularity, it displays a notable degree of *conceptual* modularity, for the main cruciform spine consists of eight large *approximate* squares (Figure 3-1). The widest part of this spine, the transept, contains the key to unlocking the overall basilica set of proportions. Measured pilaster plinth to pilaster plinth, the transept is slightly trapezoidal, tapering from 65.46 br (3820.0 cm) along the top edge, to 65.01 br (3794.1 cm) along the bottom (see Figures 3-2; and Figure 2-1, SP 25 to SP 50, and SP 15 to SP 60). Transept distortions such as this could represent intentional "architectural refinements," in this case perhaps motivated by acoustical concerns.[2] Of interest here is the smaller dimension, which exceeds 65 br by a negligible 7 mm. The number 65, when paired with 92, approximates the ratio 1:√2 within 0.08%.[3] Significantly, the length of the nave, measured pilaster plinth-to-pilaster plinth, extends 92.65 br (5407.3 cm) along the left arcade, and 92.71 br (5410.4 cm) along the right (see Figures 3-3; and Figure 2-1, FP 4 to FP 2, and FP 7 to FP 9). If we temporarily round off the transept width to a consistent 65 br, and the nave length to 92 br, these new numbers imply a closely approximated root-2 rectangle superimposed over the nave (Figure 3-4). Although the nave does not completely fill this rectangle, it would if the nave chapels had been made twice as deep as the present ones, as shown in a sketch of c.1480 by a follower and younger contemporary of Brunelleschi, Giuliano da Sangallo (Figure 3-5).[4]

According to Manetti, when Giovanni de' Medici was unable to find patrons for more than eight private chapels, he directed Brunelleschi to remove all the nave chapels that he had envisioned and Brunelleschi complied "unwillingly, because it seemed to him a miserable thing…."[5] Comparing the floor plan scheme that Brunelleschi probably intended (see Figure 3-5, minus Sangallo's hypothetical portico and second sacristy) with the one he was forced to accept (see Figure 3-5, minus the portico, second sacristy, and deep nave chapels), we can appreciate Brunelleschi's unhappiness. Not only did the nave become spatially constricted, but the root-2 rectangle proportional framework became irrelevant (see Figure 3-4, minus the nave chapels). Manetti, for his part, appears to have been equally unhappy with the *present* nave chapels, added after 1457 (see Figure 3-4).[6] His lament that "…the body of the church, from the transept downward [i.e., the nave]…although beautiful, does not conform to the aforesaid transept," implies that he, and therefore presumably Brunelleschi, would have preferred deeper and taller nave chapels identical in design to the transept chapels (see Figure 3-5).[7]

Returning now to the eight approximate squares in question (Figure 3-1), note that the dimensions that make them up, all measured plinth-to-plinth, converge around the whole number 19 (see Figure 3-6). The east-west spine of the basilica, which is composed of the high altar chapel, crossing square, and nave, varies in width from 18.88 br (1102.0 cm) to 18.96 br (1106.7 cm); the depth of the transept varies from 19.14 br (1117.1 cm) to 19.19 br (1119.8 cm); and the depth of the high altar chapel varies from 18.99 br (1108.3 cm) to 19.0 br (1108.8 cm).[8] For now let us round off all of these dimensions to 19 br even and describe the nave as 19 br wide, the transept as 19 br deep, and both the crossing square and high altar chapel as 19 br square. Thus, the total length of the basilica equals 130 br (calculated as the sum of the rounded-off high altar chapel depth, 19 br; transept depth, 19 br; and nave length, 92 br; but excluding the thicknesses of the crossing piers), or twice the transept width of 65 br. In plan, therefore, an overall proportional framework of two squares, each 65 br per side, is conceptually implied (Figure 3-7).

The four whole numbers derived thus far, 19, 65, 92 and 130, are closely interrelated through the mediation of three additional numbers, also found among the basilica dimensions, 27, 38, and 46.[9] The difference between 65 and 19 is 46 (65 - 19 = 46), or, half of 92 (92 ÷ 2 = 46). Twice 65, or, 130, minus 92, equals 38 (130 - 92 = 38), which is twice 19 (19 + 19 = 38). The difference between 92 and 65 is 27 (92 - 65 = 27), a number that, when paired with 19, produces yet another side/diagonal approximation pair, 19:27, this one accurate within 0.48%.[10] I will term these seven numbers the "65 Group" because they can all be derived from a square measuring 65 per side.[11]

3.3 Reconstruction of the Basilica Design Process

These basic geometrical and numerical building blocks imply that a logical, step-by-step design process can produce the overall basilica design that we see today. A detailed explication of that proposed reconstruction follows. While there is no way to know whether the designer of the overall basilica set of proportions proceeded exactly as proposed below, this attempt to retrace his design process suggests that the number of logical ways in which he could have arrived at the present design solution is finite, and that he must have encountered many, if not all, of the problems encountered in the reconstruction below. The following proposed reconstruction of the design process is continued by the proposed reconstruction of the basilica construction process, in Chapter 4 ("4. The Construction History of the Fifteenth-Century Basilica of San Lorenzo: A Proposed Narrative").

Step 1: Compose Schematic Diagram

A proposed reconstruction of the design process that might have produced the present overall design of the Basilica of San Lorenzo begins with a two-square rectangle measuring 65 br by 130 br (Figure 3-7).

Step 2: First Subdivision of Schematic Diagram

The two-square rectangle is then evenly subdivided into eighteen identical smaller squares (Figure 3-8).

Step 3: Second Subdivision of Schematic Diagram

Ten of these eighteen smaller squares are then subdivided into four squares each such that a cruciform area composed of eight un-subdivided squares remains between them (Figure 3-9). Comparing this diagram with the Sangallo plan, imagined shorn of all its appendages (Figure 3-5), we see that some of the smallest squares are destined to become chapels, others side aisle bays, and others, to be removed.

Step 4: Incorporate Dimensions from the 65 Group

When we attempt to assign dimensions selected from the 65 group to this diagram, we find that some of them are not commensurable with it. We can set the overall width and length equal to 65 br and 130 br without any problem (Figure 3-9), but if we want the future nave portion of the diagram to measure 92 br in length, we must stretch that portion slightly within the double square perimeter (Figure 3-10). We can then evenly redistribute the remaining 38 br into two horizontal bands of 19 br each, one corresponding to the depth of the transept and crossing square, and the other to the depth of the high altar chapel (Figure 3-10). In order to keep the crossing square truly square, not rectangular, we must also move the two vertical lines that delineate the central spine of the basilica closer together, from $21\frac{2}{3}$ br (Figure 3-9) to 19 br apart (Figure 3-10).

The preceding transformation leaves a 23 br wide vertical strip on each side of the central spine, where the transept chapels, side aisles, and nave chapels will go. Note that the sum of these widths is 46 br (23 + 23 = 46), one of the numbers of the 65 group. Also note that now the crossing square and high altar chapel areas both measure 19 br square, as we intended, but that the transept arms, which were square in our previous diagram (Figure 3-9), now measure 19 br x 23 br (Figure 3-10). The central portion of the nave, which in our previous diagram was composed of four squares (Figure 3-9), is now composed of four 19 br x 23 br rectangles (Figure 3-10). As for the future nave arcades, our diagram now contains an on-center intercolumniation of $11\frac{1}{2}$ br (Figure 3-10), which is $\frac{1}{6}$ br smaller than the $11\frac{2}{3}$ br that will be needed to establish the $9\frac{2}{3}$ br plinth to plinth distance, measured between 2 br square plinths, that is called for by the nave arcade bay set of proportions.

Step 5: Insert Column Plinths and Crossing Pier Cores

Next we insert the nave columns and the engaged square columns (or wrap-around pilasters), each of which stands on a 2 br-square square plinth. In this step we also insert the 2 br-square crossing pier cores (to which we will later attach the crossing pilasters). We begin by inserting the four crossing pier cores, and immediately confront the question of where exactly to place them. If we place them on center, the crossing square will no longer measure 19 br square between the cores but rather, 17 br square (for now ignoring the projections of the yet-to-be inserted crossing pilaster plinths). Therefore we will place these piers at the outside corners of the crossing square, such that they do not encroach into it (Figure 3-11, intersections of lines C, D, O, and P). Next we insert the nave columns, on their 2 br square plinths, such that they are evenly spaced and in alignment with the crossing pier cores (Figure 3-11, lines C and D). Finally, we mark all four corners of each future nave and transept chapel with square columns, also on 2 br square plinths (Figure 3-11, lines A, B, E, F, P, Q, and R).

As we insert these elements into the floor plan diagram, we must take care to place them such that the key dimensions of 19 br, 65 br, 92 br, and 130 br can be measured between them. Thus, the plinths that demarcate the 65 br x 130 br perimeter of the diagram are arranged *outside* that perimeter (Figure 3-11, lines A, F, G, and R), while the plinths that mark the future nave chapel openings (Figure 3-11, rows B and E) are arranged as shown in order to maintain square nave chapels and side aisle bays.

<u>Step 6: Break Schematic Diagram Into Three Parts</u>

We now encounter three problems in the floor plan diagram. First, the future nave now measures only 90 br long, plinth to plinth, rather than 92 br as we intended (Figure 3-12, O-G). Second, the future high altar chapel now measures only 17 br deep, plinth to plinth, rather than 19 br (Figure 3-11, P-R). Third, the four future transept chapels flanking the high altar chapel now measure only $7\frac{1}{2}$ br deep, plinth to plinth (Figure 3-11, P-Q), while the future nave chapels all measure $9\frac{1}{2}$ br deep (Figure 3-11, bays A-B and E-F). The first conflict is particularly serious, for without the 92 br dimension there can be no 65 br x 92 br approximate root-2 rectangle superimposed over the nave, the 65 group loses one of its key members, and the overall basilica set of proportions loses much of its geometrical and numerical significance.

There would seem to be but two possible resolutions to these conflicts: 1) switch to an on center measuring system, such that the thicknesses of the structural members become inconsequential, or 2) break up the floor plan diagram into three parts, separated by 2 br wide gaps to accommodate the crossing pier cores (Figure 3-12, rows O and P). The first solution might seem the more logical of the two, since the second solution merely spares the 92 br nave length at the expense of the 130 br overall length, which must elongate to 134 br (Figure 3-12). Nevertheless, the second solution is the one the architect appears to have chosen, and thus the one that we will reconstruct here.

Step 7: Shift Cylindrical and Square Nave Columns 1 br Toward the Transept

Breaking the diagram into three parts introduces a significant asymmetry into the nave portion of it. The nave bays adjacent to the transept become $11\frac{1}{2}$ br wide, plinth to plinth (Figure 3-12, bay N-O), while all the others remain $9\frac{1}{2}$ br wide. We can mitigate this problem by shifting all forty-two cylindrical and square columns in the nave between but not including lines G and O in Figure 4-12 toward the transept by 1 br (Figure 3-13). This shift creates $10\frac{1}{2}$ br wide bays, plinth to plinth, at both the eastern and western ends of the nave (Figure 3-13, bays G-H and N-O), while all the bays in between remain at $9\frac{1}{2}$ br wide. This new arrangement may be considered an improvement over the previous one because now the nave is symmetrical, and because the maximum variation among the nave bay widths is only 1 br (because $10\frac{1}{2} - 9\frac{1}{2} = 1$), rather than 2 br as before ($11\frac{1}{2} - 9\frac{1}{2} = 2$).

Step 8: Insert Walls

Next we connect the square columns and crossing pier cores with interior and exterior walls to enclose the basilica and form the chapels. This process is guided by the following six rules: 1) all column plinths measure 2 br square; 2) all pilaster plinths measure 2 br wide and project $\frac{1}{2}$ br from wall surfaces; 3) all pilaster shafts measure $1\frac{1}{2}$ br wide and project either $\frac{1}{4}$ br (one flute) from walls, or $\frac{1}{2}$ br (two flutes) from other pilaster shafts[12]; 4) the four crossing piers conceptually consist of 2 br-square cores to which are variously attached crossing pilasters and high altar chapel walls; 5) all interior walls, excluding the two side walls of the high altar chapel, measure 1 br thick; and 6) all exterior walls, including the two side walls of the high altar chapel, measure $1\frac{1}{2}$ br thick.

The walls, once inserted, impact the footprints of the square columns and crossing pier cores in a variety of ways. At the back corners of all the chapels, the square columns become almost completely engulfed by the walls such that only corner slivers, one flute wide on each side, remain exposed (Figure 3-14). At the entrances to the nave and transept chapels, the square columns remain fully exposed except where the chapel walls plug in from behind. Furthermore, a new irregularity now appears: the two side walls of the high altar chapel, which according to the above-noted rules must measure $1\frac{1}{2}$ br thick, join their respective crossing pier cores off-center (Figure 3-14, intersections of C, D, and P). Also note that we must remove the two square columns that would have been partially visible in the middle of each side wall of the high altar chapel (Figures 3-13 and 4-14, intersections of lines C, D, and Q)

Step 9: Insert Crossing Pilasters and Miscellaneous Pilasters

Next we insert the crossing pilasters and a few other pilasters needed to maintain the visual and/or structural logic of the classical vocabulary of the basilica (Figure 3-15, arrows). Note that when we attach pilasters to all four sides of the crossing piers, the footprints of those piers become Greek cross-shaped and each pier footprint grows to 3 br in total width (Figure 3-15). Also note that since the walls of the high altar chapel plug into the backs of two of the crossing piers off-center (Figure 3-14), those piers now contain three full pilasters and one sliver pilaster each (Figure 3-15). To the interior façade at the east end of the basilica we add clusters of pilasters to symmetrically reflect the clusters of crossing pier pilasters at the west end of the nave (Figure 3-15, row G, at C and D). We add similar clusters to the interior façade at the locations marked B and E in Figure 3-15 so that the widths of the easternmost nave chapels and nave arcade bays will all be consistent at 10 br, plinth to plinth (Figure 3-15, bay G-H). Note that in this step the crossing piers, in addition to receiving the attenuated major order crossing pilasters, also receive several minor order pilasters (Figure 3-15, arrows; and Figure 2-1: FP 4, FP 5, FP 6, FP 7, and SP 33, SP 42).

These new pilasters introduce subtle dimensional changes into the floor plan, some of which may be considered beneficial because they help to smooth out the dimensional irregularities that appeared in Figure 3-14. Note, for example, that six of the eight nave arcade bay or nave chapel openings that measured $10\frac{1}{2}$ br plinth to plinth in Figure 4-14 now measure 10 br (Figure 3-15), which is closer to the $9\frac{1}{2}$ br norm. This improvement is uneven, however, for the two nave chapels nearest the transept remain $10\frac{1}{2}$ br wide, in awkward juxtaposition with the nave arcade bays directly in front of them, which now measure 10 br (Figure 3-15, bay N-O).

Other pilasters added in this step may be considered detrimental to the clarity of the set of proportions. Four of the pilasters attached to the crossing piers, for example, reduce the widths of the adjacent bay openings to 9 br, which is $\frac{1}{2}$ br less than the norm (Figure 3-15, bays B-C and D-E). More significant, four of the newly inserted crossing pilasters introduce the dimension 18 br plinth to plinth in the vicinity of the crossing square, disrupting the consistent appearance of 19 br as our diagram had shown until now (Figures 3-14 and 3-15). Although the crossing square itself still measures 19 br square (since the plinths of the newly-inserted crossing pilasters do not encroach into the 19 br x 19 br square that can be inscribed between the corners of the crossing pier cores; see Figure 3-15), this prominent introduction of the dimension 18 br into the basilica floor plan, like the extension of the total length of the basilica to 134 br, may be considered a significant flaw in the San Lorenzo overall basilica set of proportions.

Step 10: Insert Nave Arcade Bay Set of Proportions

At this stage in our reconstruction, the two San Lorenzo sets of proportions—the nave arcade bay set of proportions, and the overall basilica set of proportions—would seem to be fundamentally incompatible with one another. The nave arcade bay set of proportions is expansive. It is based on an inflexible proportional unit composed of an overlapping square, root-2 rectangle and dual diagon measuring $13\frac{2}{3}$ br in total width (or $9\frac{2}{3}$ br plinth to plinth).[13] This unit cannot be reduced in size, but it can be extended through replication. Conversely, the overall basilica set of proportions is reductive. It is based on an inflexible proportional unit composed of a perimeter rectangle measuring 65 br x 130 br. While extension of this unit through replication would be impractical due to its large scale, it can be reduced into smaller units through subdivision.

A conflict between the two sets of proportions seems unavoidable. According to the overall basilica set of proportions a nave length of 92 br (measured plinth to plinth) is needed to produce a closely-approximated root-2 rectangle expressed with two numbers from the 65 group, 65 br x 92 br (Figures 3-10 and 3-15). We now see, however, that this nave length must be produced *both* through replication of the basic unit of the nave arcade bay set of proportions (Figures 3-2 and 3-34) *and* through subdivision of the perimeter rectangle of the overall basilica set of proportions (Figures 3-7 to 3-14). Only by a fantastic coincidence, it would seem, could such a confluence of dimensions come about; and indeed, such a coincidence very nearly occurs. Since the nave arcades each contain eight bays and terminate with $\frac{1}{2}$ br pilaster plinth projections at both ends, according to the nave arcade bay set of proportions the total nave length must measure $92\frac{1}{3}$ br, as the following component-by-component addition demonstrates (refer to floor plan, Figure 2-1):

$$\frac{1}{2} + 9\ 2/3 + 2 + 9\ 2/3 + 2 + 9\ 2/3 + 2 + 9\ 2/3 + 2 + 9\ 2/3 + 2 + 9\ 2/3 + 2 + 9\ 2/3 + 2 + 9\ 2/3 + \frac{1}{2} = 92\frac{1}{3}.$$

The overall basilica set of proportions thus far, however, produces a nave exactly 92 br long (refer to Figure 3-15):

$$\frac{1}{2} + 10 + 2 + 9\frac{1}{2} + 2 + 9\frac{1}{2} + 2 + 9\frac{1}{2} + 2 + 9\frac{1}{2} + 2 + 9\frac{1}{2} + 2 + 9\frac{1}{2} + 2 + 10 + \frac{1}{2} = 92.$$

Note that the *average* plinth to plinth dimension produced by the overall basilica set of proportions is $9\frac{5}{8}$ br (9.625 br), or, a mere $\frac{1}{24}$ br (2.43 cm) per bay less than the plinth to plinth dimension specified by the nave arcade bay set of proportions, $9\frac{2}{3}$ br (9.667 br).[14] The architect, therefore, again faced a choice: either compress each nave arcade bay by $\frac{1}{24}$ br in order to maintain a precise 92 br nave length, or stretch the nave by $\frac{1}{3}$ br in order to maintain precise $9\frac{2}{3}$ br plinth to plinth distances. My measurements indicate that he chose the latter course.[15] Perhaps he felt that to compromise the nave length by $\frac{1}{3}$ br would be a small price to pay to ensure that each nave arcade bay, with its mathematically precise set of proportions, would continue to measure exactly $9\frac{2}{3}$ br plinth to plinth, and not $\frac{1}{24}$ br less. Better to compromise the overall basilica set of proportions just a bit more, he must have reasoned—for he had already stretched the total basilica length from 130 br to 134 br (see Step 6, above)—than to compromise the nave arcade bay set of proportions at all.

In light of this analysis, the next step in our reconstruction is to remove the plinth to plinth dimensions of the nave arcades shown in Figure 3-15, and replace them with those of the nave arcade bay sets of proportions, as shown in Figure 3-16. The length of the nave now increases from 92 br to $92\frac{1}{3}$ br, and the total length of the basilica increases from 134 br to $134\frac{1}{3}$ br. A variety of smaller dimensional adjustments also become necessary. First, the square columns that stand between all the nave chapels must be shifted to align with the nave columns opposite them (Figure 3-16). One result of these adjustments is the reduction of the widths of the two nave chapel openings nearest the transept from $10\frac{1}{2}$ br to $10\frac{1}{6}$ br (Figure 3-16, bay N-O). Next, in order to maintain square proportions in each side aisle bay, the widths of the side aisles must be increased to $9\frac{2}{3}$ br (Figure 3-16, bays B-C and D-E). These adjustments reduce the depths of the nave chapels from $9\frac{1}{2}$ br, to $9\frac{1}{3}$ br (Figure 3-16, bays A-B and E-F). Furthermore, this new nave chapel depth of $9\frac{1}{3}$ br carries through to the *widths* of the two outermost transept chapels (Figure 3-16, bays A-B and E-F). These various adjustments also increase the widths of the two transept chapels that flank the high altar chapel, from 9 br, to $9\frac{1}{6}$ br; and to the portals opposite them that lead to the side aisles (Figure 3-16, bays B-C and D-E, at O and P).

The last three new dimensions noted here, $10\frac{1}{6}$ br, $9\frac{1}{3}$ br, and $9\frac{1}{6}$ br may seem impossibly obscure, but examples of all of them are found in the actual basilica measurements today, in the locations indicated in Figure 3-17. Let us look at a few of them, bearing in mind that not all the basilica measurements correspond to our reconstruction due to complex overall dimensional irregularities, such as the slight splaying of the transept width, that we have yet to examine in detail.[16] Note that the westernmost nave chapel opening on the south side (Figures 3-17; and 2-1, SP 9-SP 10) today measures 592.7 cm wide plinth to plinth, which is just 0.6 cm larger than the $10\frac{1}{6}$ br that our reconstruction predicts (Figures 3-16).[17] Nearby, the portal that leads from the left side aisle into the transept (Figure 2-1, SP 10-FP 5), measures 533.9 cm, which is just 1 cm less than the $9\frac{1}{6}$ br that our reconstruction predicts (Figures 3-16 and 3-17). Finally, the Nelli Chapel opening (Figure 2-1, SP 47-50) measures 546.7 cm, which is just 2 cm greater than the $9\frac{1}{3}$ br that our reconstruction predicts (Figures 3-16 and 3-17).

Before proceeding further with this reconstruction, we must now reckon up all those centimeters that we rounded off at the start of this analysis.[18] From our reconstruction thus far, four significant floor plan discrepancies can be identified, two in width and two in length. Though not all of their causes are clear, some of these discrepancies have characteristics that suggest systematic and intentional deviations from our reconstructed dimensions.

Floor Plan Discrepancy #1: Central Spine Width and Transept Arm Asymmetry

We have seen that the width of the east-west central spine of the basilica (the widths of the high altar chapel, crossing square, and nave) measures about 18.9 br, rather than the 19 br that our reconstruction calls for (Figure 3-6). We can precisely analyze this discrepancy as follows (refer to Figure 3-18): Note that the width of the right transept arm, measured along the eastern edge of the transept to include the width of one crossing pier core, measures just 0.6 cm less than the 23 br called for by our reconstruction (actual dimension: 1341.7 cm). The 18.9 br crossing square width is 5.1 cm less than the expected 19 br (actual dimension: 1103.7 cm). The left transept arm measures 23.11 br in width, or, 6.4 cm greater than the 23 br that our reconstruction calls for (actual dimension: 1348.7 cm). Furthermore, let us now recall that the total transept width, measured along the edge nearest the nave, is a mere 0.7 cm greater than 65 br (actual dimension: 3794.1 cm).[19] Let us assume that this excess 0.7 cm was added as part of a construction error involving the left transept arm, the only component of the total transept width that is larger than our reconstruction calls for. If we subtract 0.7 cm from the width of the left transept arm (thus accepting it as a construction error and removing it, for now, from our discussion in order to make the total transept width exactly 65 br), that left arm now becomes only 5.7 cm too wide (because 6.4 cm—0.7 cm = 5.7 cm). Since the crossing square width, 18.9 br, is 5.1 cm too narrow relative to 19 br, only 0.6 cm of excess width in the left transept arm remains to be accounted for (because 5.7 cm—5.1 cm = 0.6 cm). This excess width is precisely compensated by the 0.6 cm *deficiency* in the width of the right transept arm, noted above.[20]

We may conclude from this analysis that the entire south (left) side of the central spine, including the south wall of the high altar chapel, the two southern crossing piers, and the south nave arcade, has been shifted about 5 cm north of where it is supposed to be (Figure 3-18, line D). Furthermore, the entire row of square columns one bay south of this line appears to have been shifted along with it by nearly the same distance (Figure 3-18, line E). This second shift is evidenced by the width of the arched portal that leads from the transept to the south side aisle: The width of this portal, as we have seen, does not measure 5 cm *greater* than $9\frac{1}{6}$ br, as we would have expected had this row not been shifted north. Rather, it measures 1.1 cm *less than* $9\frac{1}{6}$ br (actual dimension: 533.9 cm; Figure 3-17). Apparently the builders, in shifting this row of square columns (Figure 3-18, line E) north in order to keep it the correct distance from the neighboring row of crossing piers and cylindrical columns (Figure 3-18, line D), went 1.1 cm too far.

The reason for these apparent northward shifts of two entire rows of vertical supports in the basilica by the minute distances in question is unknown. Construction error, though possible, seems unlikely given both the importance of the crossing square dimensions, and the great dimensional accuracy achieved by the masons elsewhere in the transept. Equally unlikely seems the possibility that the masons sought firmer footing for the south crossing piers. Soil characteristics would not differ significantly over such small distances, and in any case, the masons could have made the crossing pier foundations, which are not visible above ground, as large as they wanted without necessitating a shift of a few centimeters in the above-ground locations of the piers that they support.[21] The question remains unresolved.

Floor Plan Discrepancy #2: Splayed Transept

Earlier I noted that the transept gradually decreases in width, from 65.46 br (3820.0 cm) along the western edge, to 65.01 br (3794.1 cm) along the eastern edge, for a difference of 25.9 cm (Figure 3-2). We can now determine that this slightly trapezoidal shape is also slightly asymmetrical, as follows (refer to Figures 3-2 and 3-19): First, moving along the eastern edge of the transept from north to south (see Step 1, Figure 3-19), we cross the 23 br-wide north transept arm, and continue another $9\frac{1}{2}$ br southward, to the point that would have marked the central axis of the basilica had the central spine measured exactly 19 br plinth to plinth (because 19 br ÷ 2 = 9.5 br). Thus, we move a total of $32\frac{1}{2}$ br (or half of 65 br) to the south. Next we draw an assumed lengthwise central axis through this point and measure the north transept arm from it, but this time measuring along the wider, western edge of the transept (see Step 2, Figure 3-19). Finally, we subtract this distance from the total width of the western edge of the transept to obtain the width of the south transept arm along this edge. These measurements reveal that the southwest corner of the transept extends to the south 17.4 cm beyond the orthogonal, while the northwest corner extends to the north only 9.2 cm beyond the orthogonal.[22]

Floor Plan Discrepancy #3: Transept Depth

The depth of the transept measures approximately $19\frac{1}{6}$ br, with a maximum variation of just 2.7 cm along the full north-south width of the transept (Figure 3-6). This approximately $\frac{1}{6}$ br (about 10 cm) deviation from the 19 br that we expected to find seems too large and consistent to be a product of construction error, but the reason for it is unknown. It is perhaps related to the former location of the old campanile (see Chapter 4).[23]

Floor Plan Discrepancy #4: Nave Length

This reconstruction first called for a nave length of 92 br (Figure 3-15), and then $92\frac{1}{3}$ br (Figure 3-16). My measurements, however, reveal that the actual nave length is longer still, varying from about $92\frac{2}{3}$ br along the south nave arcade, to nearly $92\frac{3}{4}$ br along the north arcade (Figure 3-3). Where do these excess nave arcade lengths—18.6 cm in the south arcade and 21.8 cm in the north—come from? A component-by-component analysis of the nave dimensions indicates that they are the cumulative results of numerous minute discrepancies distributed over the length of each arcade, primarily concentrated in the eastern four bays.[24] All but two of these discrepancies appear to be the results of construction error. Those two exceptions occur in the easternmost bay of each nave arcade, in which the plinth to plinth distances are more than 10 cm wider than the others (Figure 3-17). Such large discrepancies suggest intentional enlargement of that last nave bay, though for what reason is unknown. The nave length measurements are analyzed in two spread sheets shown in Figure 3-20. The first compares reconstructed (expected) total nave lengths against actual total nave lengths, the latter having been recorded in single readings from a long tape measure. The second compares reconstructed component dimensions against actual component dimensions, and thus allows us to pinpoint the locations of discrepancies distributed within the total dimensions. These discrepancies are also plotted in the two bar charts in Figure 3-20. Note the very large excess nave arcade bay widths in the easternmost bay of each arcade, labeled measurement line 16 in the spread sheets and bar charts. In theory the total nave lengths and the sum of the corresponding component measurements should be identical, but small discrepancies nevertheless appear (labeled "error" at the bottom of the second spread sheet), probably due to a combination of decimal rounding and measurement error in the present analysis.

These bar charts and spread sheets tell us that some of the nave length component dimensions are smaller than expected, most are larger (especially those at measurement line 16; see Figure 3-20), and that the sum of all the discrepancies in each nave arcade accounts for all but a few millimeters of the nave arcade length that exceeds $9\frac{1}{3}$ br. Thus the south nave arcade measures 5407.3 cm, which exceeds the length we expected based on our reconstruction, 5388.6 cm ($92\frac{1}{3}$ br), by 18.7 cm. Our component-by-component dimensional analysis shows exactly where 18 cm of that 18.7 cm discrepancy comes from (Figures 3-17 and 4-20). While the remaining 0.7 cm may be attributed to measurement error, we must also attribute to measurement error the 1.2 cm discrepancy between the total nave length as measured in one go with a long tape measure along the south arcade, 5407.3 cm (Figure 3-3), and the total of all the component measurements of the same arcade, 5406.1 cm (Figure 3-17); since in theory the two should be identical. Alas, no dimensional analysis of a building of this scale will ever tally up to the last millimeter. Readers may similarly analyze the north arcade measurement data in the same manner on their own. We may conclude that although the overall basilica set of proportions called for a nave length of 92 br, the architect accepted a compromise length of 92 $\frac{1}{3}$ br, and construction error added another $\frac{1}{3}$ br to the south nave arcade and nearly $\frac{3}{4}$ br to the north nave arcade.

3.4 Cross-Section Proportions

Thus far in our reconstruction we have raised the design of the basilica of San Lorenzo to about half its intended height. We have laid out the floor plan in detail, not yet including the sacristy and double chapel appendages (Figure 3-16), and we have erected four pilaster-clad crossing piers of yet-to-be-determined heights at the corners of the crossing square. We have erected two rows of cylindrical columns in alignment with those piers to the east to delineate the nave, and two square columns to the west of them to mark the back corners of the high altar chapel (Figure 3-16, line C and D). We have erected two rows of square columns on each side of this central spine to mark out the rest of the basilica (Figure 3-16, lines A, B, E, and F), and we have connected these square columns and two of the crossing piers with walls to create exterior enclosure and interior chapels. Atop the cylindrical nave columns we have placed entablature blocks of heights specified by the nave arcade bay set of proportions, and we have spanned them with semi-circular arches that have archivolts measuring 1 $\frac{1}{2}$ br in face width, to match the column diameters below (Figures 2-2 and 2-34).

We can now fill in a few more pieces of the above-ground portions of the basilica, which our floor plan reconstruction automatically implies. Atop all of the square columns and the walls that interconnect them we now place a continuous entablature corresponding in height to the entablature blocks of the nave arcades (Figures 2-3 and 2-51). Springing from this entablature, above all the transept chapel openings, we place arches formed of archivolts measuring 1 $\frac{1}{2}$ br in face width, just like those of the nave arcades (Figures 2-3 and 2-51). We place similar arches above all the nave chapels, even though their archivolts will be mostly embedded in the tympana and vaults of the side aisles, such that only the edges will be visible (Figures 2-3, 2-51, and 3-16, lines B and E). All of the elements discussed thus far—cylindrical columns, square columns, entablature blocks, entablatures, and archivolts—belong to the minor order. To complete our reconstruction, which we left off at Step 10, let us push upward to establish the heights of the major order.

Step 11: Determine Upper Entablature Height According to the Root-2 Rectangle

The upper entablature is a broad, horizontal datum of *pietra serena* and plaster that circumscribes the cruciform central volume of the basilica (Figures 2-1 and 2-51). Since this entablature rests on the peaks of the nave arcade arches, the height of its lower edge is predetermined by the nave arcade bay set of proportions. We would expect that lower edge to occur $24\frac{1}{4}$ br, or 1415.2 cm, above the floor.[25] Indeed, my survey shows it to be quite close to this dimension, at 1411.8 cm.[26] The height to the *top* of this entablature, however, is not pre-determined by the proportions we have established thus far. Rather, it is determined by a large root-2 rectangle.

We have seen that the width of the nave, measured plinth to plinth where the nave arcades meet the crossing piers, is approximately 18.9 br, or approximately 1104.5 cm (Figure 3-6). A root-2 rectangle based on this dimension would rise 1562.0 cm (because $1104.5 \times \sqrt{2} = 1561.99\ldots$; Figure 3-21). The *actual* height of the top of the upper entablature is 1562.2 cm—a negligible discrepancy of 2 mm., or, 0.01%.[27] Note that a nave width of 19 br (1108.8 cm) plinth to plinth would have produced, based on the proportions of a root-2 rectangle, an upper entablature height of 26.87 br (1568.1 cm, or approximately $26\frac{4}{5}$ br). A third option the architect might have considered, however, would have been to set this height equal to 27 br, thereby approximating the proportions of a root-2 rectangle using two whole numbers from the 65 group, 19 and 27, and tying the proportions of the nave cross section to those of the Old Sacristy, as we will see.[28] The difference between these two options is 0.48%, or 7.6 cm (the same as the error in the 19:27 approximation), and thus large enough to have required a conscious choice between the two. In the actual construction we know that the *capomaestro* in charge chose the geometrical option, presumably because the numerical option was not available due to the 18.9 br nave width, which precluded the possibility of creating a true 19:27 ratio. Evidence suggesting that the architect originally intended the numerical option, however, is perhaps provided by the transept ceiling height, which measures exactly 38 br, a number that is closely related to 19 and 27 as part of the 65 Group discussed previously.[29]

Step 12: Determine Crossing Pilaster Heights

In its cruciform journey around the perimeter of the basilica, the upper entablature passes through all four corners of the crossing square. At these four points eight tall crossing pilasters appear to support it (Figure 2-1). These major order pilasters share all the dimensions of the minor order pilasters except the shaft height: the crossing pilaster capital height measures $1\frac{2}{3}$ br; the plinth width, 2 br; the combined plinth-plus-base height, $\frac{3}{4}$ br; and the shaft widths, $1\frac{1}{2}$ br. The architect appears to have determined the crossing pilaster shaft height simply by placing the plinth-plus-base assemblies at floor level, setting the capitals directly below the upper entablature, and stretching the fluted shafts between them—quite an elastic, medievalizing approach to proportioning the classical orders. Since four of the crossing pilasters stand at floor level, while the other four stand atop three steps, the crossing pilaster shaft heights vary considerably (Figure 2-1). The shaft height of Crossing Pilaster 1, for example, measures 1312.5 cm (22.49 br), while that of Step Crossing Pilaster 6 measures only 1250.1 cm (21.42 br).

Step 13: Add Upper Entablature

Since the upper entablature rests directly atop the nave arcade arches (Figure 2-3), we might expect it to rest directly atop the transept chapel arches, and the other minor order arches, as well (Figure 2-51). When we recall, however, that the nave arcade arches span plinth to plinth distances of $9\frac{2}{3}$ br, while the transept chapel arches, according to our reconstruction, span plinth to plinth distances of either $9\frac{1}{3}$ br or $9\frac{1}{6}$ br (Figure 3-16), we realize that since all the arches are semicircular, the transept chapel arches cannot be as tall as the nave arcade arches because they have smaller radii. If the upper entablature remains horizontal as it passes from the nave into the transept, therefore, we would expect gaps to appear between the tops of the transept chapel arches and the bottom of the upper entablature. We would expect those gaps to be of two different sizes: 9.7 cm above the $9\frac{1}{3}$ br chapels, and 14.6 cm above the $9\frac{1}{6}$ br chapels.[30] Gaps do indeed appear above the transept chapel arches, but not quite as large as anticipated, for two reasons. First, due to the slight splaying of the transept noted previously (Figures 3-2 and 3-19), most of the chapel openings flanking the high altar chapel were built slightly wider than our reconstructed dimensions, and the chapel arches are thus correspondingly taller (Figures 3-16 and 3-17). Second, my survey, combined with visual observations made from scaffolding, indicates that the upper entablature sags slightly as it enters the transept from the nave (Appendix 8.1). Today the gaps are filled with improvised–looking cushions of plaster and wood, perhaps placed there by the original masons.

Step 14: Determine Ceiling Height According to the Double Square

The crown molding that traces the perimeter of the wooden ceiling of the basilica has a complex profile, in the middle of which is a flat fascia oriented parallel to the floor. The distance between this fascia and the floor, measured in the left transept arm (the oldest portion of the basilica) is 2217.0 cm, or nearly exactly 38 br.[31] Thus, had the nave measured 19 br wide, as our reconstruction suggests the architect originally intended, the height of the nave would have measured exactly twice the width, and the nave cross section would have conformed to the proportions of a two-square rectangle (in Figure 3-22). This two-square rectangle, furthermore, would have precisely overlapped with the bottom and sides of the root-2 rectangle shown in Figure 3-21 provided that the latter rectangle, too, had been based on a nave width of 19 br (rather than 18.9 br, as described above). Such an overlapping geometrical figure would have resembled the overall geometry of our Step 4 floor plan diagram (Figure 3-10), except that the latter contains the three largest numbers from the 65 group: 92, 65, and 130; while this one would have contained the three smallest: 19, 27, and 38. The preceding observations thus reveal a curious inconsistency in the proportions of the basilica as executed, the explanation for which is not yet clear: The actual ceiling height of 38 br is related, via the proportions of a two-square rectangle, to the *reconstructed* nave width of 19 br, while the actual upper entablature height of 26.77 br corresponds is related, via the proportions of a root-2 rectangle (Figure 3-21), to the *actual* nave width of 18.9 br.

Since the crossing dome was completed by Antonio Manetto di Ciaccheri in the 1450s and was criticized by contemporaries as having been built at variance with Brunelleschi's intentions, and since the lantern was reconstructed by the Ruggieri brothers in the 1780s, we will forego proportional analysis above the level of the ceiling crown molding.[32]

3.5 The Old Sacristy

Scholars have reached no consensus as to whether the Old Sacristy should be considered an integral part of the basilica of San Lorenzo, or a separate work.[33] Based on visual evidence, both positions would seem to have merit. The sacristy aspires to autonomy with its fully-glazed north windows that seem never to have anticipated construction of the abutting basilica that blocks them. Conversely, both structures are unified by a consistent pilaster capital design that is so distinctive it might be named San Lorenzo Corinthian. The overall basilica sets of proportions now provides compelling evidence that the two structures were indeed conceived as an integral complex. Although scholars unanimously agree that the domed main room of the Old Sacristy was intended to measure 20 br square, wall-to-wall, even though some acknowledge significant discrepancies with actual conditions, measuring pilaster plinth to pilaster plinth produces a more convincing proposal.[34] Measured as such the main room comes out to 19 br square, with errors of just 2.4 cm in width and 1.7 cm in length, and the total length of the sacristy including the *scarsella* measures within 3.4 cm of 27 br.[35] The sacristy floor plan thus contains a closely approximated root-2 rectangle formed of two numbers from the 65 group, 19 br x 27 br (Figure 3-23).[36]

The Old Sacristy is even more integrated with the basilica proper than these two numbers suggest. Since both the main room of the Old Sacristy and the basilica crossing square are nearly exactly 19 br. square, the domes that cover them are nearly identical in size, even though the sacristy dome appears much larger because it is closer to the ground (Figures 3-24 and 3-25).[37] Furthermore, we have seen that my survey reveals that in the basilica, the nave cross-section conforms to the proportions of a root-2 rectangle, when measured plinth-to-plinth in width, and to the top of the upper entablature in height, within a negligible discrepancy of 2 mm (0.01%; Figure 3-21).[38] Since the width in question is nearly 19 br, it is possible that the nave cross-section was conceived as an approximate root-2 rectangle measuring 19 x 27 br; which would be but a vertical reiteration of the Old Sacristy floor plan proportions (Figure 3-23). This hypothesis is consistent with the basilica ceiling height, which we have seen measures exactly 38 br (Figure 3-22).[39] Not only are all three of these numbers in the 65 Group, but together they imply a proportional framework for the nave cross-section consisting of a double square with a root-2 rectangle inscribed within it (Figures 3-21 and 3-22)—essentially a smaller version of the proportional framework for the overall basilica floor plan which, it will be recalled, is dimensioned with three other numbers from the 65 Group: 65, 92, and 130 (Figure 3-10). This abbreviated analysis of the overall basilica and Old Sacristy sets of proportions leaves little doubt that both structures were conceived together, as an integral whole. A more detailed analysis of proposed Old Sacristy sets of proportions will be presented later in this study, after the completion of our reconstruction of the overall basilica sets of proportions, to which we will now return.

Step 15: Derive Old Sacristy Proportions from Overall Basilica Proportions

The basic relationships between the overall basilica sets of proportions and those of the Old Sacristy have been discussed.[40] Let us now observe how the Old Sacristy footprint can be derived geometrically from the overall basilica floor plan proportions. When we overlay onto our last single-line floor plan diagram (Figure 3-10) a sideways, 65 br by 92 br approximate root-2 rectangle, a rectangular strip measuring 27 br wide remains (Figure 3-26). When we next extend to the left the two horizontal lines that define the transept, we have the 19 br x 27 br proportional footprint of the Old Sacristy (Figure 3-26). Within this new rectangle we then mark off a 19 br square to represent the main room of the sacristy, and within the 8 br x 19 br space that remains we mark off an 8 br square to represent the *scarsella* (Figure 3-26). Next we arrange square columns, wrap-around pilasters, and walls in and around this diagram such that the dimensions shown in Figure 3-27 can be realized (Figure 3-28). Finally, we move the entire sacristy away from the basilica proper by a distance equal to the thickness of the wall that they share, plus the pilaster plinth projections on both the sacristy and basilica sides (Figure 2-1; note that we have not yet shifted the sacristy to the west, as shown in this figure). I have measured this total distance as 150.4 cm (2.58 br), though whether this combined wall and plinth thickness found in the actual basilica today is the dimension the architect intended is unknown.

<u>Step 16: Determine Old Sacristy Vertical Dimensions</u>

The Old Sacristy appears to lack any geometrical sets of proportions relating the floor plan to the elevations. The main room does not consist of a cubic volume surmounted by a semi-spherical dome as it might appear (Figures 3-24, 3-28 and 3-29), and although the *scarsella* portal (Figure 3-29) may compositionally resemble both the San Lorenzo nave arcade bays and Serlio's perspective portal (Figures 2-2 and 2-37), it contains none of the sets of geometrical proportions that I have identified in those compositions.[41] Some of the dimensions inside the sacristy, however, appear to have numerical significance. The height of the dome, measured from the floor to the flat soffit ring that encircles the oculus, is nearly exactly 33 br (Figure 3-29).[42] As a pair of 3s, the number thirty-three (33) forms an iconographical ensemble with the four-sided main room of the sacristy and the twelve-lobed melon dome that covers it (Figure 3-24), such that all of these elements can be interpreted as the twelve (12) "…disciples preaching the Trinity (3) throughout the 4-fold world."[43]

By measuring the *scarsella* portal between the same key points of measurement that we examined in our analysis of the San Lorenzo nave arcade bays, the following dimensions are revealed: the plinth to plinth distance is $6\frac{1}{2}$ br; the pilaster shaft height, not including the astragal, is $9\frac{1}{3}$ br; and the total order height, measured to the top of the entablature, is $12\frac{1}{6}$ br (Figures 3-27, 3-28, and 3-29).[44] Note that the fractional endings of these numbers decrease in magnitude according to a 3:2:1 relationship ($\frac{1}{2} : \frac{1}{3} : \frac{1}{6}$ = 3:2:1), and that their sum is 1, or, "unity" ($\frac{1}{2} + \frac{1}{3} + \frac{1}{6}$ = 1). The integers to which these fractions are attached, 6, 9, 12, increase according to a 2:3:4 relationship

(6:9:12 = 2:3:4), all of them are multiples of 3, perhaps again symbolizing the Trinity; and their sum is 27 (6 + 9 + 12 = 27), which is both a number from the 65 group and the length of the sacristy in *braccia*.

The architect of the sacristy may not have had much flexibility in establishing the major horizontal divisions of the Old Sacristy once he decided to set the dome height from the floor at 33 br. The height of the dome, from the flat top of the crown molding to the soffit of the oculus ring, measures very nearly $10\frac{1}{4}$ br (597.1 cm). The middle stage of the sacristy, which is characterized by four large, semicircular-arched walls, has nearly the same height (596.75 cm). These dimensions, however, which vary by a centimeter or two around the circumference of the sacristy, are probably not numerically significant. Since both the dome and the middle stage of the sacristy are based on semicircular structures that spring from the walls of the main room, their heights were largely predetermined when the lengths of the side walls were established at 19 br. Some limited opportunity for height adjustment remained, for example, in the gap between the top of the middle stage and the base of the dome, which is partially filled by the crown molding at the base of the dome, but probably not enough to permit any significant numerical adjustment.

While other seemingly significant numerical relationships between the various architectural elements of the Old Sacristy, and between these elements and the corresponding features of the basilica proper, can be found, there is insufficient evidence to determine whether they are the results of the architect's intentions or mere coincidence.[45] We must conclude, therefore, that the Old Sacristy has a rather lackluster set of proportions compared to that of the basilica proper—an assessment that, considering the prominence of this structure in the canon of western art, would seem to support my earlier assertion that perceived aesthetic value and sets of proportions are unrelated. Having now concluded our examination of the Old Sacristy sets of proportions, we have but one more small step to complete in our reconstruction of the overall basilica sets of proportions.

Step 17: Design Modifications

Five floor plan modifications remain to bring our reconstruction thus far (Figures 3-16, which does not include the Old Sacristy) into conformity with the final scheme that Brunelleschi and Giovanni de' Medici agreed upon (see Figure 2-1, not including the present nave chapels and New Sacristy). These modifications are not logically implied by the preceding step-by-step reconstruction. Rather, they appear to be contingent transformations, made in response to social and economic pressures outside the pure logic of geometry. First, we must shift the Old Sacristy to the west, to its present position out of alignment with the crossing square. This shift, if indeed the Old Sacristy were aligned with the crossing square at some early step in the design process, was perhaps undertaken in order to allow the transept to terminate with chapels at both ends, thus increasing the number of transept chapels and spatially enlivening the ends walls. Another reason for such a shift, however, may have been to avoid an appearance of excessive grandeur for this structure that was effectively a Medici family mausoleum. Second, we must add the double chapels to the transept end walls, which appear to have been conceived as appendages that are independent of the overall basilica sets of proportions.[46] Third, we must turn the nave chapels nearest the transept to face the transept, again perhaps for the purpose of increasing the number of transept chapels (Figure 2-1, chapels SP12–SP15 and SP 60–SP63).[47] Fourth, we must remove the nave chapels, apparently due to the inability of the church to assemble enough patrons willing and able to build them.[48] Since none of these transformations appears to have implications for the San Lorenzo overall basilica sets of proportions, we need not discuss them further.

We now come to the end of our reconstruction of the overall basilica sets of proportions, with the Old Sacristy and four contingent design modifications evident in the present design taken into account. That system appears to have played a critical role in determining the form, scale, number of chapels, and spatial distribution of the Basilica of San Lorenzo. While sets of proportions appear to have imbued the basilica with a rich layering of intended meaning related to geometry, number and arithmetic, it may also have created at least one unintentional layer of meaning that could have caused confusion among early visitors to the church had the stewards of the design and construction process, perhaps making additions to the architect’s original design, not taken remedial action. That potential source of confusion was unintented number symbolism, and the remedial action, if indeed any was taken, appears to have manifested itself in sculptural relief carving.

In this section I will propose an iconographical reading of the entablature block frieze reliefs of the San Lorenzo nave arcades that relates this sculptural program to an apparently unintended consequence of the San Lorenzo sets of proportions. Like any iconographical interpretation that proceeds without the benefit of unambiguous documentary evidence, my proposed reading is conjectural. Whether or not it proves to be an accurate description of historical design decisions and the motivations behind them, however, this proposed reading serves as a useful platform from which to explore a significant area of knowledge pertaining to medieval and Renaissance sets of proportions that I have not yet addressed in this study.

3.6 Symbolic Numbers and the Entablature Block Frieze Reliefs

The preceding reconstruction has revealed several important numbers embedded in the sets of proportions of the Basilica of San Lorenzo, the most significant of which are those ending in the fraction $\frac{2}{3}$ and those associated, through a variety of relationships, with the number 65. These numbers, expressed within the sets of proportions in *braccia*, are invisible and can only be comprehended mentally. To find them one needs either measuring equipment or access to the original design specifications. Consequently, these numbers were probably accessible only to a select group of people, such as the architect and his associates, the church adminstration, and the leading members of the community who were involved in the design and construction of the basilica.

Another number embedded in the design of the basilica is accessible to everyone, however, and probably attracted the keen interest of many fifteenth century visitors—the number seven (7), which is embodied in the dominant architectural feature of the basilica, the pair of monumental nave arcades composed of 7 columns each (Figures 2-1 and 2-3). This number is accorded added visual prominence due to the smooth surfaces of the unfluted, cylindrical column shafts, which contrast markedly with the textured surfaces of the fluted, rectangular pilaster shafts that characterize all other vertical point supports in the basilica. The pilasters thus tend to recede from view, bringing the columns into sharp foreground relief. The preceding step-by-step reconstruction of the San Lorenzo sets of proportions and floor plan demonstrates the likely reason for this particular number of columns in each arcade: A two-square rectangle, subdivided in a logical succession of steps, produces a nave floor plan 8 bays long, with 7 pairs of freestanding columns marking the points of connection between them (Figures 3-7 to 3-16).

The preceding reconstruction may provide a logical geometrical explanation for this prominent double appearance of the number 7, but most early fifteenth-century visitors to the basilica would have required a more immediately comprehensible explanation. For them, numbers could connote vivid meanings, and as such they effectively constituted a third category of number, distinct from the counted and counting numbers discussed above.

Previously I noted that counted numbers signify tangible quantities such as 7 columns or a length of 2 *braccia,* and that counting numbers signified numerical concepts that have no bearing on the material world, as in the observations that 3 follows 2, or that 3 is composed of 3 unities. In order to understand the problem that the presence of 7 columns in a nave arcade might have presented to the early fifteenth century observer, we must examine a category of number that acknowledges both quantity and abstract meaning, like counted and counting numbers, respectively, yet does not primarily signify either. In this study a symbolic number will be defined as a number that to the medieval and Renaissance mind signified programs of non-numerical meaning. Most numbers, perhaps with the help of a few external prompts to the observer, could fall into this category since every number between 1 (unity) and 9 bore some latent symbolic meaning, and others could take on the compounded meanings of smaller ones.

One (1, or unity) symbolized God.[49] Two (2) signified sin, for it was the first to recede from unity, the "First Good."[50] Three (3) symbolized the Trinity.[51] Four (4), according to Vincent Foster Hopper, whose book, *Medieval Number Symbolism*, serves as an important source for this analysis, signified the "mundane sphere," for it was associated with "…the 4 winds, the 4 elements, the 4 seasons, and the 4 rivers." Thus, "…knowledge of divine things is disseminated throughout the world by the 4 gospels, evangelists, or beasts, emblemized by the 4 extremities of the cross, the 4-fold division of Christ's clothing, and the 4 virtues, or forms of love, as Augustine names them."[52] Five (5) represented those living under Old Dispensation of the Pentateuch; the 5 points of the cross, the 5 wounds which provided the salvation of man, who has 5 fingers and 5 senses; and the 5 loaves blessed by Jesus that fed 5,000.[53] Six (6) were the days of creation, and 6 were the ages of mankind, from the Creation to the Second Coming.[54] Seven (7) provided the basic structure of the universe, and daily life within it: there were 7 planets, 7 days, and 7 canonical hours.[55] Seven (7) was the Sabbath, both as the 7th day, and the 7th age.[56] Eight (8) was the number of salvation, regeneration, and the Resurrection, for according to Augustine, the eighth day following the Creation represented a return to the original life.[57] Nine (9), as three sets of 3, amplified the symbolism of the Trinity. Larger numbers could additionally carry symbolism of their own. Twelve (12), for example, as the product of 3 and 4, represented the twelve (12) "…disciples preaching the Trinity (3) throughout the 4-fold world."[58] In a variation on this theme, the inner surface of the dome over the scarsella of the Baptistery of Padua is painted with 13 lobes containing figures of the 12 apostles plus the Virgin Mary.

The degree to which number symbolism melded with every aspect of medieval and early Renaissance thought is difficult for us to comprehend today, for during those periods no gap existed between the abstract and the concrete.[59] "Take number from all things, and all things perish" wrote the Early Christian philosopher Isidore of Seville (d. 636),[60] and this belief would have been particularly relevant to architecture. Numbers of walls, numbers of bays, numbers of columns, numbers of towers—all were bearers of number symbolism. Indeed, for an architect to design a building devoid of number symbolism would have been impossible. The experience of number symbolism was spontaneous, and could be profoundly moving. Johannes Scotus Erigena, a ninth century theologian and Neo-Platonist philosopher, writes that whenever he thinks of 8, thoughts of Easter, the resurrection, regeneration, spring, and new life "vibrate" within him.[61] What thoughts might have "vibrated" within the fifteenth-century observer who contemplated the 7-column nave arcades of San Lorenzo? Which of the many possible meanings of 7, if any, might the architect have intended to convey to him? In order to address these questions, I will first identify three subcategories of number symbolism that had the potential to interact with architectural form during the medieval and Renaissance periods, and then examine the 7-column nave arcades of San Lorenzo in relation to each. These three types of number symbolism, which I will term associative, generative, and derivative, required three different levels of participation on the part of the architect.[62]

Associative Number Symbolism

Associative number symbolism required no participation on the part of the architect, for it occurred when an observer spontaneously associated a number of objects with some symbolic meaning. Some observers, for example, might have associated the 7-column nave arcades of San Lorenzo with wisdom, in reference to the Old Testament passage: "wisdom has built her house; she has hewn out its 7 pillars."[63] Alternatively, since all 7 columns in each nave arcade—and thus, all 14 of the nave columns—support entablature blocks decorated with carved lambs, another Old Testament passage might have come to mind, in which God calls for a series of offerings, including 14 lambs on each of the 7 days of the Feast of Tabernacles.[64] In a fifteenth century basilica dedicated to a Christian saint however, we might expect associative number symbolism to draw from New rather than Old Testament sources, unless selected references to both were meticulously juxtaposed in the mind of a well-educated observer through a more overt iconographical program.[65]

Among the many references to 7 found in the New Testament, the 7 flames of the Holy Spirit, and the 7 seals of the Book of the Apocalypse stand out as the most emotive, and will be considered in detail below.[66] Others include the mass, which Hopper notes is composed of 7 parts, or offices: "the full episcopal procession is led by 7 acolytes, indicating the 7 gifts of the [Holy] spirit. Then follow the pontiff, 7 subdeacons (7 columns of wisdom), [and] 7 deacons (from apostolic tradition)…".[67] Alternatively, 7 might have represented the sum of the 3 theological and 4 cardinal virtues, or the 7 deadly sins.[68] Less conventional interpretations develped by leading thinkers also emerged, such as, for example, Aquinas's argument that "…the number 7 signifies universality because the life of man revolves through 7 days, because of the 7 gifts of the Holy Spirit, because faith in the Trinity was announced through the 4 parts of the world, because there are 7 churches."[69] Augustine, for his part, found in scripture 7 steps to wisdom, 7 beatitudes, and, in the Lord's Prayer, 7 petitions.[70]

Generative Number Symbolism

Generative number symbolism required the most active participation on the part of the architect, for it occurred when symbolic numbers were used to generate architectural form. Early Christian basilicas typically contain nave colonnades composed of 12 columns each, as a representation of the New Testament assertion that Christianity was carried forth into the world by 12 apostles. Indeed, considering the notable resemblance between columns and human figures, such churches may even be considered examples of an Early Christian *architecture parlant*.[71] At San Lorenzo we find no evidence of generative number symbolism in the overall basilica design. I have argued that the 7 columns appear to have been placed in each nave arcade for reasons other than number symbolism. Only in architectural details do we find two possible examples of generative number symbolism, both based on the Trinity: 3 steps lead up to the transept and nave chapels (Figure 2-1); and in the entablature blocks that date to the earlier 1442-1457 nave construction campaign, 9 eggs (or, 3 x 3) fill each side of the egg-and-dart cornice molding (Figure 2-24).[72]

Derivative Number Symbolism

"Derivative number symbolism" occurs when an architect assigns iconographical significance to numbers that appear in his buildings as unintentional by-products of the design process. The architect thus *derives* the symbolism from the building, rather than designing the building with the aim of expressing that symbolism. Note that according to this definition, the actor must be the architect (or architects) and not an observer, as in associative number symbolism, no matter how closely associated with the design and construction process that observer may have been. Thus, this definition treats intangible symbolic intent as an integral component of design, equally important as the physical manifestations thereof. Note, furthermore, that the means of communication by which the architect assigns number symbolism to a building is not important. The symbolic content can be connoted by some physical sign such as a carved decorative motif, or by a surviving verbal comment. As long as we have some evidence of symbolic intent combined with some indication that the design of the building preceded this intent, we may say that we have an example of derivative number symbolism.[73]

Derivative number symbolism is often difficult to distinguish from generative number symbolism, and therefore must remain a matter of scholarly interpretation, which of course must be clearly identified as such. One apparent example of derivative number symbolism that the architects appear to have attempted to pass off as generative number symbolism is found in the archives of the cathedral of Milan. In 1392, in response to the criticisms of the French architect Jean Mignot, the

Italian master masons defended their design for a large crossing tower surrounded by four smaller towers, with the following elaborate argument:

> "…[The masters] say that the towers which they wanted to make are for many reasons and causes [desirable]. Namely, in the first place, to integrate aforesaid church and transept so that they correspond to a rectangle according to the demands of geometry, but beyond this, for the strength and beauty of the crossing-tower. To be sure, as if as a model for this, the Lord God is seated in Paradise in the center of the throne, and around the throne are the four Evangelists according to the Apocalypse, and these are the reasons why they were begun."[74]

The symbolism of the four evangelists in this passage has the ring of an afterthought; a seemingly desperate defense against the foreigner's criticisms. Surely, as the architects themselves seem to acknowledge, stylistic precedents, geometrical logic, and structural concerns were the primary factors leading to the inclusion of four corner towers in the design, not number symbolism. Nevertheless, in this passage the Italian architects may also have communicated a genuine mystical vision that, although most likely derived *from* their design, must be considered an integral part of their total design intent, even if that intent evolved during the course of the discussions. Returning now to the Basilica of San Lorenzo, we find one possible example of derivative number symbolism, and it is recorded in stone rather than a church document.

<u>The Seven-Sealed Book of the Apocalypse</u>

We have seen that above each column and pilaster in the nave arcades is an entablature block frieze decorated with elaborate carved reliefs. Each relief depicts a pair of winged cherubim inflected inward, in adoration of a smaller scene framed by a laurel wreath (Figures 2-22, 2-24, 2-25, 2-28 and 2-29). The smaller scene contains a lamb, in the western three bays usually illuminated by a halo embellished with a cross (Figures 2-22 and 2-24). The lamb reclines on a rectangular slab, which is tilted to reveal its top. Along the front edge of the slab are arrayed 7 vertical lozenges. These lozenges suggest a deliberate attempt on the part of the designer of these reliefs—whether Brunelleschi or not will be considered shortly—to tie the number of columns in each nave arcade, 7, into an iconographical program.

The halo with cross definitively identifies the lamb as Christ, the *Agnus Dei*, the Lamb of God. In this context, the slab and seven lozenges together imply the seven-sealed book of the Apocalypse—updated in format from the biblical scroll—with which the *Agnus Dei* is typically associated in Christian iconography.[75] Support for this interpretation of the slab as a book, if not of the seven lozenges as seals, is found in the reliefs of the entablature blocks of Columns 5 and 10. The sculptor of these blocks clearly understood the slab to represent a book, for in each of the eight reliefs found on all four sides of these two entablature blocks, the slab bears unambiguously book-like details, including a stack of pages between two covers, and two straps or clasps securing them together (Figures 3-30 and 3-31). The sculptors of these blocks may have been overly ambitious, however, for in adding the aforementioned details they rendered the seven lozenges rather ambiguous—they appear more like flames lapping at the edge of the book than seals set in place to secure its contents. In most of the other entablature block reliefs of the nave arcades however, the slabs are more abstract, and the 7 lozenges overlap the leading edge in a manner consistent with the function of seals on a book (Figures 2-22, 2-24, 2-25, 2-28 and 2-29). A rendition of the Agnus Dei reclining atop a book bound by metal clasps that is similar to those of the entablature block reliefs found above Columns 5 and 10 found in the late *trecento* painting by Jacobello Alberegno titled "Polittico dell'Apocalisse (Figure 3-32), suggests that the San Lorenzo sculptors provided new interpretations of an established iconographical design.[76]

My interpretation of the lambs, slabs, and lozenges in the entablature block friezes as representations of the *Agnus Dei* and the seven-sealed Book of the Apocalypse, now raises the question of why this theme would have been given such prominence in a basilica dedicated to St. Lawrence, especially since the small portion of decorated exterior terra cotta frieze that was completed under Brunelleschi's supervision and that today outlines the perimeter of the Old Sacristy and Medici double chapel bears the similarly arranged, but more clearly relevant, motif of a gridiron--the instrument of St. Lawrence's martyrdom--flanked by winged angels (Figures 3-33 and 3-34).[77] The *Agnus Dei* standing on the seven-sealed Book of the Apocalypse, and holding the banner of the Cross, appeared on seals of the early Church, and thus may be considered a general symbol of Christianity,[78] but the replacement of the seemingly more iconographically appropriate gridiron motif with this one demands further explanation. A lamb quite similar to the entablature block lambs occupies the shield of the *Arte della lana* (Figure 3-35), but the wool guild, which was the patron of the *opera* of Santa Maria del Fiore and thus, Brunelleschi's patron for the cupola project, would seem to have lacked sufficiently strong connection either to this church or the Medici family to warrant such prominent iconographical representation in the San Lorenzo nave arcades.

A more likely explanation for the choice of the seven seals motif in the entablature block friezes is that the designer of the friezes believed that a powerful iconographical image was needed to accompany the inadvertently powerful symbolism of 7 columns marching down each side of the nave. For early fifteenth century visitors to the basilica these columns would have "vibrated" with the varied meanings of 7, and visitors would have looked to the iconographical program of the basilica for guidance as to which meanings to pay attention to. If no guidance was to be found, iconographical confusion might have resulted. Thus, the entablature block designer perhaps intended to prevent the basilica from becoming a locus of *ad hoc* associative number symbolism by providing a carefully orchestrated program of derivative number symbolism that would link the number 7 to the culminating event of the New Testament, the opening of the seven seals of the Book of the Apocalypse. It is a scriptural vision lodged in the last book of the New Testament, Revelation, in which the heavens open up to reveal the Lord himself seated on his throne (Rev. 8:1–6), in which his temple in heaven is opened to reveal the ark of the covenant (Rev. 11:19). It is, furthermore, an account suffused with seven: 7 churches, 7 spirits, 7 golden lampstands, and 7 stars (Rev. 1); 7 blazing lamps, the 7 spirits of God (Rev. 4:5), 7 horns and 7 eyes, the 7 spirits of God sent out into all the earth (Rev. 5:6), 7 bowls, 7 last plagues (Rev. 16:1, 21:9), and an earthquake that kills 7,000 (Rev. 11:13). The lamb takes the scroll "sealed with 7 seals" (Rev. 5:1) from the hand of God (Rev. 5:7). Seven (7) angels stand before God (Rev. 8:2) bearing 7 trumpets (Rev. 8:7–15). Seven (7) thunders speak (Rev. 10:3), and after the 7th seal is opened and the 7th angel sounds his trumpet, the vision of the Apocalypse is fulfilled:

> "…there were loud voices in heaven, which said: 'The kingdom of the world has become the kingdom of our Lord and of his Christ, and he will reign for ever and ever.'" (Rev. 11:15).[79]

If a central purpose of church architecture is to direct the attention of its occupants toward the contemplation of God and the liturgy of the church, then this iconographical program would have helped to fulfill this purpose in a most forceful way.

Design Attribution of The Entablature Block Friezes Reliefs

Early twentieth-century scholars questioned whether Brunelleschi designed the entablature block frieze reliefs, or whether his followers added them to his design, perhaps without his permission.[80] If the latter scenario were to be true, then Brunelleschi may not have been concerned about potentially ambiguous associative number symbolism that the two rows of 7 nave columns in the Basilica of San Lorenzo may have implied. Although docoumentary evidence indicates that two of the friezes could have been completed prior to Brunelleschi's death in 1446, there is no evidence that Brunelleschi continued in his role as *capomaestro* of the basilica construction project after 1429 except for a brief consultation with regard to the relocation of the choir made, according to Manetti, at Cosimo de' Medici's request.[81]

Indeed, another reason to question Brunelleschi's authorship of the entablature block friezes comes from those limited portions of the basilica that were unquestionably completed under his supervision, the Old Sacristy—not including the Donatello/Michelozzo embellishments—and the adjacent double chapel. Those portions contain an iconographical program that focuses on the theme of St. Lawrence. In addition to the above-noted exterior frieze that bears the gridiron motif, the instrument of St. Lawrence's martyrdom (Figures 3-33 and 4-34), another prominent manifestation of Laurentian iconography found not only in the Old Sacristy and adjacent chapel but throughout the basilica is the profusion of laurel wreath motif that adorns all the archivolts (Figures 2-3, 2-32 and 2-33). The laurel wreath is a primary symbol of Saint Lawrence, whose Roman name, *Laurentius*, derives from the Latin *lauream tenens*, or "one who holds a laurel wreath."[82] Laurel wreaths are also incorporated into the exterior terra cotta frieze motif, where they form roundels that frame the angels that flank the gridiron—angels which, according to some traditions, bore the saint's soul to heaven immediately following his martyrdom (Figures 2-33 and 2-34).[83]

For Brunelleschi to have interjected into this highly focused Laurentian iconographical program the apparently unrelated theme of the Apocalypse would seem contrary to his tendency toward consistency in all aspects of his designs. In this context Manetti's comment that "…the body of the church from the transept downward…although beautiful, does not conform to the aforesaid transept," takes on new potential relevance.[84] In addition to the nonidenticailty of the present nave and transept chapels noted previously, perhaps the marked contrast between the sculptural friezes of the entablature blocks and the minor order frieze in the transept constituted another source of Manetti's dissatisfaction with the appearance of the nave as executed. Except for the lack of ornament, the continuous minor order frieze in the transept closely resembles the entablature blocks of the nave arcades when it forms projections above the square columns of the transept chapel portals (Figure 2-51). Perhaps Brunelleschi intended blank entablature block friezes in nave arcades, like those in his later basilica of Santo Spirito (Figure 2-50).

The sculptural friezes of San Lorenzo have no parallels that can be securely attributed to Brunelleschi. The polychrome terra cotta frieze roundels in the Old Sacristy were executed by Donatello, probably as part of his collaboration with Michelozzo, and according to Manetti angered Brunelleschi.[85] If the San Lorenzo entablature block friezes were not designed by Brunelleschi, then Michelozzo and Donatello in collaboration would seem the most likely authors. These men collaborated not only on the elaborate interior embellishment of Brunelleschi's Old Sacristy, including the frieze motif that resembles that of the entablature blocks, but perhaps also on the addition of the high niches and other features to the San Lorenzo transept end walls.

The possibility that the sculptural frieze reliefs in the entablature blocks might have been added by Brunelleschi's successors, perhaps without his permission, suggests that the basilica Brunelleschi intended might have had not only more volume, provided by the deeper and taller nave chapels discussed above, and less light, due to the smaller clerestory windows that could have been accomodated above them, but also considerably less ornament in the nave arcades. While we have no way of knowing whether Brunelleschi would have been concerned about possible iconographical ambiguity resulting from 7-column nave arcades surmounted by blank—and thus iconographically mute—entablature block friezes, the Basilica of Santo Spirito strongly indicates that Brunelleschi was aware of the iconographical potential of number symbolism and was capable of using it to forceful effect.

At Santo Spirito we find nave arcades composed of 8 freestanding columns (each of which is terminated by two engaged columns, for a total of 10 visible columns) surrmounted by blank entablature block friezes. No visitors to that basilica, however, would have been confused by possible number symbolism embodied in the numerical quantity of 8 (or 10) columns in each nave arcade because the important number there is clearly 9, the number of bays that the columns separate. If there were ever any doubt about the Trinitarian intent of this apparent example of generative number symbolism, the number of bays that each of the transept- and apse-like wings project from the crossing square, 3, would have allayed them. In a basilica dedicated to the Holy Spirit, which is the third component of the Trinity, the number 3 would have have had particular resonance for fifteenth-century visitors. The recurrence of the number 9 in the plinth to plinth distances, measured in *braccia* (discussed in detail below), would have further reinforced that symbolism for those who were aware of the dimensions. Whatever Brunelleschi's intentions may have been for the design of the San Lorenzo nave arcade entablature block friezes, however, he may not have determined the number of columns in each arcade. Extensive evidence suggests that he inherited that number, along with all the most notable counted and counting numbers found throughout the basilica, from his predecessor as *capomaestro*. Indeed, those very numbers, which are embedded in the sets of proportions found throughout the basilica, constitute some of that evidence.

[1] Manetti, *Vita*, Tanturli, ed., 111.

[2] Cf. the slightly trapezoidal transept in the floor plan of the church of S. Pietro in Toscanella. William Henry Goodyear, "Constructive Asymmetry in Medieval Italian Churches," *Architectural Record* 6, no. 3 (Jan.-Mar. 1897), 401, Figure 18. For the term "architectural refinements," see William Henry Goodyear, "Architectural Refinements in Early Byzantine Churches and French Cathedrals," *Architectural Record* 16, no. 2 (Aug. 1904), 116-140. Similar non-parallel walls flank the stage area of the basilica-like Seiji Ozawa Music Hall, Lenox, Massachusetts, 1986, William Rawn Associates, Architects, Inc., as a device to mitigate the acoustical phenomenon of "flutter echoes." See Scott R. Riedel, *Acoustics in the Worship Space* (St. Louis, Missouri, 1986), 23. According to Manetti, the San Lorenzo choir was originally to be placed in the crossing square, perhaps motivating the construction of non-parallel transept end walls. Manetti, *Vita*, Tanturli, ed., 109; Irving Lavin, "Donatello's Bronze Pulpits in San Lorenzo and the Early Christian Revival," in *Past-Present: Essays on Historicism in Art from Donatello to Picasso*, (Berkeley, California 1993), 6; and Saalman in Manetti, *The Life of Brunelleschi*, Saalman, ed. 147-148 note 143.

[3] The side/diagonal approximation pair 65:92 is not generated from the simplest form of Theon of Smyrna's formula (see Figure 3-49). However, beginning with a theoretical square with a side of 1 and a diagonal of 4, it is produced in the fifth generation of the formula; and beginning with a side of 5 and a diagonal of 6, in the fourth generation. Thus, the formula can produce a far greater number of accurate approximation pairs than our analysis thus far has indicated.

[4] Giuliano da Sangallo, "Tacuino senese," fol. 21v, Biblioteca Comunale, Siena.

[5] Manetti, *Vita*, Tanturli, ed., 108.

[6] On the construction of the present nave chapels see Moreni, *Continuazione*, 1:14; Ginori Conti, 1940, pp. 72–73; Roselli and Superchi, *L'edificazione*, 104-124, 128-129; and Saalman, *Filippo Brunelleschi: The Buildings*, 439, Document 12.1.

[7] *Ibid*., 111.

[8] Excluded from consideration here is the width of the high altar chapel measured plinth-to-plinth along the rear wall, 1114.1 cm (19.09 br), since both plinths that bound that dimension date to the nineteenth century. Valerio Tesi, "I restauri di Gaetano Baccani," in *San Lorenzo, 393-1993* (Florence, 1993), 163-164. The remaining high altar chapel measurements may vary slightly from original measurements since all three chapel walls were reconstructed in the eighteenth century. See floor plans (April 1742) showing the scope of work directed by architect Giuseppe Ruggieri in *San Lorenzo, 393-1993*, 26. There is no evidence to support Battisti's claim that at some point in the

design process Brunelleschi reduced the dimensions of the transept. Eugenio Battisti, *Brunelleschi: The Complete Work* (New York: Rizzoli, 1981), 188.

[9] Note, however, that 46 is divided into two symmetrical transept widths of 23 each (see Figure 4-10).

[10] Indeed, these numbers contain five side/diagonal approximation pairs: 19:27, 27:38, 46:65, 65:92, and 92:130, which vary in accuracy from 0.08% to 0.48%.

[11] These numbers can also be derived, in close approximation, through two different series of rotated squares (the first consisting of three squares, with sides measuring 19, 27, 38; the second consisting of four squares measuring 46, 65, 92, 130), other geometrical constructions (such as an overlapping root-2 rectangle and double square rectangle having a short side measuring either 46 or 65), or simple arithmetical intervals (note that the intervals between 46, 65, 92, 130 are 19, 27, 38). The number 65 also bears a relationship to the nave arcade set of proportions: in the above-noted progression $1\frac{2}{3}$, $5\frac{2}{3}$, $9\frac{2}{3}$, $13\frac{2}{3}$, $17\frac{2}{3}$, the next number is $21\frac{2}{3}$. When converted to complex fractions through simple arithmetic as described previously, these numbers become $\frac{5}{3}$, $\frac{17}{3}$, $\frac{29}{3}$, $\frac{41}{3}$, $\frac{53}{3}$, $\frac{65}{3}$.

[12] See for example SP 42 (Figure 2-1), the shaft of which projects $\frac{1}{2}$ br (two flutes) from the crossing pilaster on the east side, and $\frac{1}{4}$ br (one flute) from the wall on the west side.

[13] See Cohen, "How Much Brunelleschi?...," 19-37.

[14] Note that this average calculation is not used here as a substitute for statistical analysis, which would not be a mathematically valid procedure, but merely as a way to even out all the bay widths produced by the overall basilica set of proportions. See Appendix 8.4).

[15] In fact, his choice was a bit more complicated than indicated here, because $9\frac{5}{8}$ br itself would seem to have presented a viable plinth to plinth distance within the nave arcade set of proportions (refer to the preceding analysis of the nave arcade set of proportions.). Assuming 2 br plinth widths, both the distance between the farther edges of the column plinths and the column shaft height could have measured $13\frac{5}{8}$ br; and the height to the tops of the entablature blocks, derived from the dual diagon proportion, could have measured $17\frac{5}{8}$ br (compare to Figure 2-45). The capital height could

have measured $1\frac{5}{8}$ br to begin a progression of Boethian root hexagonal numbers that would have been called out by flags of repeating $\frac{5}{8}$ fractions, rather than $\frac{2}{3}$. Note that the ratio $9\frac{5}{8}$: $13\frac{5}{8}$ is equivalent to the whole number ratio 77:109, which approximates the ratio 1:√2 within 0.1%. A root-2 rectangle and a dual diagon derived from a plinth to plinth distance of $9\frac{5}{8}$ br, therefore, would have risen 2.5–2.6 cm short of the required $13\frac{5}{8}$ br and $17\frac{5}{8}$ br dimensions, respectively. By comparison, the corresponding discrepancy associated with the dimensions $9\frac{2}{3}$, $13\frac{2}{3}$, $17\frac{2}{3}$ is only 1-3 mm, which perhaps accounts for their selection.

[16] On the splaying of the transept, see Cohen, "How Much Brunelleschi?...," 37.

[17] The arch that spans this $10\frac{1}{6}$ br chapel opening has been imperceptibly flattened out to appear equal to the other chapel arches nearby, a feat that is more readily accomplished here than in the transept since here, the chapel portal archivolt is embedded in the side aisle vaults, with only the soffit edge remaining visible (Figures 2-1 and 2-51).

[18] On the temporary dimensional rounding, see Cohen, "How Much Brunelleschi?...," 37.

[19] On transept width measurements, see Cohen, "How Much Brunelleschi?...," 37.

[20] Good fortune may be playing a role here, since a measurement error of several millimeters over such a long distance would not be unusual. In this case, however, the component measurements add up to the overall transept width measurement with no error at all. Also note that the portal leading from the transept into the north side aisle (Figure 2-1, FP 6-SP 65) measures only 9.11 br (531.6 cm), or 3.36 cm less than $9\frac{1}{6}$ br (Figure 3-17). This discrepancy can be accounted for by the slightly excessive widths of the adjacent chapel opening and nearby pilaster plinths.

[21] One final dimensional irregularity that we may observe in the central spine of the basilica is a slight splaying of the nave, widening from Columns 7 and 8 toward the east end of the nave (Figure 3-6). This irregularity is so slight, however—on the order of 1-2 cm—that I will attribute it to construction error.

[22] On a possible acoustical reason for this splaying of the transept, see Cohen, "How Much Brunelleschi?...," 37.

[23] This apparent enlargement of the transept by $\frac{1}{6}$ br is unrelated to Battisti's unsubstantiated suggestion that Cosimo de' Medici reduced the dimensions of the transept "by almost one bay from east to west." Battisti, *Filippo Brunelleschi*, 188.

[24] On the increased dimensional irregularity of the eastern four bays of the nave compared to the western three bays, see Cohen, "How Much Brunelleschi?...," 21-23.

[25] If we assume the arch diameter to be equal to the clear intercolumniation of $10\frac{1}{6}$ br (since both archivolt face width and column diameters measure $1\frac{1}{2}$ br wide), the assumed height of the lower edge of the upper entablature can be calculated as follows: entablature block height from floor ($17\frac{2}{3}$ br) + arch radius ($5\frac{1}{12}$ br) + archivolt face width ($1\frac{1}{2}$ br) = $24\frac{1}{4}$ br.

[26] This measurement was recorded between Columns 8-9 (see Appendix 8.1). The cause of the 3.4 cm discrepancy (1415.2 - 1411.8 = 3.4) is unknown, though arch settlement is one likely possibility. Alternatively, since the 1411.8 cm measurement was recorded as the height to the top of the archivolt, not the bottom of the entablature, it is possible that 3-4 cm gaps, invisible from the floor, separate the tops of the arches and the bottoms of the entablatures.

[27] This measurement was recorded between Columns 8-9. This root-2 rectangle proportional relationship, however, displays a comparable level of precision when measured in all three westernmost bays of the nave.

[28] See Cohen, "How Much Brunelleschi?," 40-41.

[29] *Ibid*. See also Step 12 below.

[30] We have seen that an arch that spans a plinth to plinth distance of 9 2/3 br has a radius (and thus a height) of $5\frac{1}{12}$ br, or, 296.64 cm. An arch spanning a plinth to plinth distance of $9\frac{1}{3}$ br would have a radius of $4\frac{11}{12}$ br, or, 286.94 cm. The difference between the two is thus: 296.64 cm - 286.94 cm = 9.7 cm. An arch spanning a plinth to plinth distance of $9\frac{1}{6}$ br would have a radius of $4\frac{5}{6}$ br, or, 282.07 cm. Thus, 296.64 cm - 282.07 cm = 14.57 cm (rounded to 14.6 cm).

[31] Measured in June 2005 with a Leica Disto A5 Laser Distance Meter. Measurements vary between 2217.4 cm and 2218.1 cm. Note that 2217.0 cm ÷ 58.36 cm = 37.99 br, and that 2218.1 cm ÷ 58.36 cm = 38.0 br.

[32] Manetti, *Vita*, ed. Tanturli, 1976, 110–111; *Archivio Mediceo l. c. filza 9*, quoted in Giovanni Gaye, *Carteggio inedito d'artisti dei secoli XIV, XV, XVI* (Florence, 1839), 1:167–169; and Valerio Tesi, "La 'generosa pietà' dell'elettrice palatina: restauro e completamento della basilica laurenziana nel tramonto dei Medici," in *San Lorenzo, 393-1993, L'Architettura: le vicende della fabbrica*, eds. Gabriele Morolli and Pietro Ruschi (Florence, 1993), 152.

[33] Fabriczy considers the two structures to be integral, Battisti sees them as separate, and Saalman seems to take both positions, calling the Old Sacristy "…a contiguous but wholly separate building" while nevertheless embedding his discussion of it within the San Lorenzo chapter of his Brunelleschi monograph. Cornel von Fabriczy, *Filippo Brunelleschi: Sein Leben und seine Werke* (Stuttgart: J. G. Cotta, 1892), Chapter 5; Battisti, *Brunelleschi: The Complete Work*, 79-97, 174-196; and Saalman, *Filippo Brunelleschi: The Buildings*, 113, 107-209, 113-144.

[34] Saalman, *Filippo Brunelleschi: The Buildings*, 209; Zervas, *The Parte Guelfa*, 148; and Pietro Ruschi, "Considerazioni di storia e architettura," in Francesco Gurrieri, ed., *La Sacrestia Vecchia di S. Lorenzo: Il comportamento statico e lo stato di conservazione* (Firenze, 1986), 24.

[35] The measurements are: 1110.5 cm, or 19.03 br, long (west wall), 1111.2 cm, or 19.04 br, wide (south wall), and 1579.1 cm, or 27.06 br, total length (west wall). Note that 19 br = 1108.84 cm (see Figure 3-28).

[36] Nyberg proposes a root-2 rectangle relationship in the Old Sacristy floor plan indicated wall-to-wall, but provides no measurements. D. Nyberg, "A Study of Proportions in Brunelleschi's Architecture," master's thesis, New York University, 1953, 2-15. Zervas proposes that measured wall to wall, the floor plan proportions of the Old Sacristy conforms to those of a root-2 rectangle: "…the ground plan of the Old Sacristy is a rectangle of 20 by 28 *braccia*. Such a rectangle is in fact a rationalized 1:√2 rectangle, based on a module of 1 *braccio*. Diane Finiello Zervas, *The Parte Guelfa, Brunelleschi, and Donatello*, Locust Valley, New York, 1987, p. 148. According to my measurements, however, the total length of the main room is only 1624.6 cm., or 27.84 br. (Figure 3-28). Furthermore, the ratio 20:28, even if it were found in the Old Sacristy floor plan, could not be described as a "rationalized 1:√2 rectangle," but merely as a rather poor approximation of the proportions of such a rectangle, for it has an error of 1.4%, compared to the that of the ratio 19:27 which approximates the proportions of the root-2 rectangle within 0.48%. Cf. Ruschi, "Considerazioni," 24-25.

[37] Although the San Lorenzo crossing dome was executed by Antonio di Manetto Ciaccheri, evidently at variance with Brunelleschi's exact intentions, Antonio would have had little flexibility

regarding the dome diameter. See Isabelle Hyman, "Towards Rescuing the Lost Reputation of Antonio di Manetto Ciaccheri," in *Essays Presented to Myron P. Gilmore*, 2:261-280.

[38] The precision of this proportional correspondence with actual measurements proves that the root-2 rectangle shown in Figure 3-21 is tied to the nave width measured plinth-to-plinth, and *not* in the clear, between crossing pilaster shafts, as proposed by Saalman, who provides no measurements. A root-2 rectangle drawn as Saalman proposes would rise 41.09 cm higher than the actual upper entablature height. Saalman, *Filippo Brunelleschi: The Buildings*, 361-362. The root-2 rectangle proportions of the nave cross-section of Santo Spirito correspond to those of San Lorenzo (Figure 3-21) with similar accuracy.

[39] The distance from the main floor to the horizontal soffit in the middle of the crown molding profile, measured near the door to the Old Sacristy, is 2218.4 cm, or 38.01 br (Figure 3-22).

[40] Cohen, "How Much Brunelleschi?," 40-41.

[41] See Cohen, "How Much Brunelleschi?," 19-37.

[42] The actual dome height is about 3-4 cm less than 33 br. The heights from the vestment table surface to the soffit of the oculus ring, measured in four locations with a Leica Disto A5 Laser Distance Meter, are 1825.1 cm, 1824.0 cm, 1825.7 cm, and 1825.7 cm. Each of these measurements was added to the average table height, 97.65 cm, to produce the following four interior dome heights, from the floor to the oculus ring soffit: 1922.75 cm (32.95 br), 1921.65 cm (32.93 br), 1923.35 cm (32.96 br), and 1923.35 cm (32.96 br). Note that 33 br = 1925.88 cm.

[43] Vincent Foster Hopper, *Medieval Number Symbolism: Its Sources, Meaning and Influence on Thought and Expression* (New York, 1938), 99.

[44] Based on my survey (Appendix 8.1), these measurements are: 381.8 cm, or 6.54 br (plinth to plinth distance); 543.7 cm, or 9.32 br (left column shaft height); 544.4 cm, or 9.33 br (right column shaft height); 710.5 cm, or 12.17 br (order height at left pilaster); 710.3 cm, or 12.17 br (order height at right pilaster). The column and order heights noted here are measured to the bottoms of the plinths of the square columns at the *scarsella* entrance. Note that in the Old Sacristy, the pilasters and square columns stand at three different levels: The northwest corner pilaster stands on the floor of the main room. The square columns and pilasters along the *scarsella* wall stand on the first step leading up to the *scarsella*, and the square columns at the rear of the *scarsella* (which appear as sliver pilasters), stand at the level of the *scarsella* floor. Apparently troubled by this height variation, Stegmann and Geymüller incorrectly show the latter sliver pilasters without plinths. Carl von Stegmann and Heinrich von Geymüller, *Die Architektur der Renaissance in Toskana* (Munich, 1885), 1: Bl. 6.

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[45] Some of the smaller vertical dimensions in the *scarsella* portal bear root-2 scalar relationships with the corresponding basilica dimensions. For example, the sacristy capital height, $1\frac{1}{6}$ br, and entablature height, $1\frac{2}{3}$ br, bear a 7:10 relationship to one another (a side/diagonal approximation accurate within 1.02%), while the two corresponding dimensions in the basilica proper, $1\frac{2}{3}$ br (capital height), and $2\frac{1}{3}$ br (the entablature block height that was likely intended), bear a 5:7 relationship (side/diagonal approximation accurate within 1.01%). Furthermore, the height of the sacristy order, measured from the sacristy floor to the top of the entablature, $12\frac{1}{2}$ br, is smaller than the total height of the minor order in the basilica, $17\frac{2}{3}$ br, by a ratio of 75:106—or, very nearly $1{:}\sqrt{2}$ ($12\frac{1}{2} : 17\frac{2}{3} = 75{:}106$), which is another side/diagonal approximation accurate within 0.06%.

[46] This interpretation of the double chapels differs from that of Bruschi, who treats these chapels as integral to the original overall floor plan layout. Arnaldo Bruschi, *Filippo Brunelleschi* (Milan, 2006), 107-109.

[47] There is no reason to believe that the nave chapels nearest the transept were ever intended to open to both the nave and transept as Saalman suggests. Howard Saalman, *Filippo Brunelleschi: The Buildings* (University Park, Pennsylvania, 1993), 206-207. Such a configuration, as shown in Saalman's axonometric drawings (Saalman, *Filippo Brunelleschi: The Buildings*, Figures 11 and 13), would have introduced just two instances of a new structural element into the architectural vocabulary of the basilica—the freestanding square fluted column—and would have placed them in confusing juxtaposition to the engaged square fluted columns (wrap-around pilasters), and the freestanding cylindrical unfluted columns. Freestanding square columns such as those Saalman proposes would thus have created an architectural hodge-podge that Brunelleschi would not likely have tolerated, for the very reason that Saalman himself states: "Brunelleschi…preferred to work with few, relatively undifferentiated, parts in his designs to express homogeneity and uniformity rather than hierarchy and variety." Saalman, *Filippo Brunelleschi: The Buildings*, 206. The Santa Trinita precedent, which Saalman cites as the only supportive evidence for his proposal, has limited relevance here because, while it has two chapels that open to both the transept and the nave, it contains only rectangular piers and pilasters. Thus, the corner chapels of S. Trinita are supported by freestanding piers that blend harmoniously with all the other piers in the basilica.

[48] On the removal of the nave chapels, see Cohen, "How Much Brunelleschi?," 56 n. 99.

[49] Hopper, *Medieval Number Symbolism*, 99-100 (hereinafter Hopper). On the oneness of God, Hopper quotes Aquinas as follows: "The human soul requires many and various operations and powers. But to angels a smaller variety of powers is sufficient. In God there is no power or action beyond his own Essence" (*Summa Theologica*, I, qu. 77, art. 2, as quoted in Hopper, p. 99). Hopper furthermore notes that according to Alanus de Insulis, "God is unity because unity regulates all plurality" (Regulae Alani de sacra theologia; P.L. 210, 623, as quoted in Hopper, p. 100). Similarly, in a discussion of cubic numbers Alberti, as noted previously, writes: "The first of all Cubes, whose Root is one, is consecrated to the Deity, because, as it is derived from One, So it is One every Way." (see p. 104 n. 52).

[50] Hopper, 100.

[51] Hopper notes: "References to the Trinity do not become common or definitive until the third century and the doctrine was not to receive its final and official formulation until the Council of Constantinople (A. D. 381)" (Hopper, pp. 73 and 73 n. 10).

[52] Hopper, pp. 71-72, 83-84; Matthew (24:31); and Revelation (7:1). Umberto Eco additionally notes that "there were "four cardinal points…four phases of the moon, four letters in the name 'Adam,' and four was the constitutive number of Plato's tetrahedron, which corresponded to fire. Vitruvius taught that four was the number of man, because the distance between his extended arms was the same as his height—thus giving the base and height of a square. Four was the number of moral perfection, and men experienced in the struggle for moral perfection were called 'tetragonal'" (an expression that calls to mind my own boyhood Cub Scout pledge to "…be square and obey the laws of the pack) Umberto Eco, *Art and Beauty in the Middle Ages*, New Haven and London, 2002, 35-36.

[53] Hopper, pp. 74, 84 n. 58. Umberto Eco additionally notes that "there were five essences of things, five elementary zones, five genera of living creatures (birds, fish, plants, animals, men). Five was the number of Divinity, and was scattered throughout the Scriptures (the Pentateuch, the five wounds). The number five was found in man, for if the extremeties of his body were joined by straight lines they formed a pentagon." Ibid, 36; and cf. Edmund Reiss, "Number Symbolism and Medieval Literature," *Medievalis et humanistica*, n.s. 1, 1970, 161-174.

[54] Alfred W. Crosby, *The Measure of Reality: Quantification and Western Society, 1250-1600*, Cambridge, 1997, p. 29.

[55] *Ibid*., pp. 29, 33.

[56] Seven represents the "Sabbath and Salvation" (Hopper, p. 85), and on Judgement Day, Albertus Magnus writes, the 7 ages of the world would come to an end (Hopper, p. 112).

[57] Hopper, p. 77.

[58] Hopper, p. 99. Similarly, Early Mesopotamian witings include references to “the four corners of the universe” and “heaven’s four corners.” Piotr Michalowski, :”Masters of the Four Corners of the Heavens: Views of the Universe in Early Mesopotamian Writings,” in *Geography and Ethnography: Perceptions of the World in Pre-Modern Societies*, eds. Kurt A. Raaflaub and Richard J. A. Talbertp, Oxford, 2010, 153.

[59] I paraphrase here Hopper’s remark: “…in the medieval mind a weblike structure of abstract ideas and concrete realities [was] so closely interwoven and interdependent that no serious gap was felt to exist between them” (Hopper, p. vii). This rather literal interpretation of medieval iconography is useful as a general guideline for understanding medieval number symbolism, but must be approached with caution. In a more general discussion of medieval architectural iconography, Crossley notes the problematic nature of the so-called *Strukturforschung* school, exemplified by Sedlmayr’s proposal that Gothic architecture was an actual representation of Heaven, and not merely a symbol thereof. Rather, Crossley proposes, “The Christian church had always seen individual churches as metaphors of the Heavenly Jerusalem…” (Paul Crossley, “Medieval Architecture and Meaning: The Limits of Iconography,” *Burlington Magazine*, February, 1988, pp. 118-119).

[60] As quoted in: Hopper, p. 113.

[61] As quoted in Richard Krautheimer, “Introduction to an ‘Iconography’ of Mediaeval Architecture,” *Journal of the Warburg and Courtauld Institutes*, V, 1942, p. 9.

[62] Krautheimer similarly distinguishes between three types of symbolic interpretation of particular geometrical forms in architecture, each of which corresponds to one of the three categories of number symbolism proposed here (which I have inserted, in brackets, into the following passage by Krautheimer): “Rather than being either the starting point [generative symbolism] or else a *post festum* interpretation [derivative symbolism], the symbolical significance is something which merely accompanied the particular form which was chosen for the structure [associative symbolism].” *Ibid*., p. 9.

[63] Proverbs, 9:1.

[64] Numbers, 29:12–32

[65] See, for example, the fresco cycles of the Arena Chapel and the Sistine Chapel, to name just two well-known iconographical programs that juxtapose scenes from the New and Old Testaments.

[66] Revelation, 4:5, 5:1.

[67] Hopper, p. 115.

[68] Hopper, p. 84–85.

[69] Hopper, p. 95, cf. p. 85. On the 7 gifts of the Holy Spirit, see Isaiah, 11:1-3.

[70] Hopper, pp. 84-85.

[71] On the symbolic association between columns and people, see: John Onians, , Bearers of Meaning: The Classical Orders in Antiquity, the Middle Ages, and the Renaissance (Princeton, 1988), p. 8; on the Early Christian symbolism of 12 columns, see: Onians, *ibid.*, p. 70ff. Similarly, Krautheimer cites numerous examples of centralized medieval buildings that contain 8, 12, or 20 columns or piers, evidently in direct reference to the 8 columns and 12 piers (20 total supports) in the rotunda of the Holy Sepulchre in Jerusalem (Richard Krautheimer, "Introduction to an 'Iconography' of Mediaeval Architecture," *Journal of the Warburg and Courtauld Institutes*, V, 1942, p. 10ff.). In the Early Christian basilica of S. Apollinare Nuovo in Ravenna, glittering mosaic processions of white-robed figures, walking toward the apse, occupy frieze bands above each arcade, and thus perhaps implying a direct relationship between columnar and human form.

[72] Hopper notes: "The altar steps are always 3 or some multiple" (Hopper, p. 114). That the total number of transept chapels, including the high chapel, that Giovanni de' Medici and Brunelleschi agreed to is also 9 is probably coincidental with regard to number symbolism, since Manetti's account, as we have seen, indicates that this number resulted from political and economic considerations (see p. 26).

[73] Note, however, that if symbolic intent existed in the mind of the architect but no evidence of it survives, we must assume that it did not exist.

[74] James Ackerman, "'Ars Sine Scientia Nihil Est': Gothic Theory of Architecture at the Cathedral of Milan," *Art Bulletin*, XXXI, 1949, 2, p. 100.

[75] Revelation, 4–11, 5:1; Margaret Kremers, "The Sculptured Friezes in the Nave of San Lorenzo," Thesis (bachelor's or master's not specified), Smith College, 1933, pp. 2-4.

[76] Galleria dell'Accademia #17, Jacobello Alberegno, "Polittico dell' Apocalisse," c. 1360 to 1390 (cat. 1000).

[77] This decorated exterior frieze constitutes one aspect of Brunelleschi's work that is prefigured in the architecture of ancient Rome, for example, in the sculptural frieze of the 1st century B. C. Temple of the Sibyl at Tivoli, but not in any work of the Tuscan Romanesque period. On the question of Roman influences, or lack thereof, in the works of Brunelleschi, see: Marvin Trachtenberg, "On Brunelleschi's Choice: Speculations on Medieval Rome and the Origins of Renaissance Architecture," in *Architectural Studies in Memory of Richard Krautheimer*, Cecil L. Striker, ed., Mainz, 1996, pp. 169-173.

[78] Kremers, *op. cit.*, pp. 3-4.

[79] Revelation 8:1, 11:15. In this account we also find themes of 4, linking the vision of the Apocalypse to the mundane world: "…I saw 4 angels standing at the 4 corners of the earth, holding back the 4 winds of the earth…" (Revelation, 7:1).

[80] Kremers notes that at the time of her writing, the theory that the entablature block frieze reliefs of San Lorenzo should be attributed to a follower of Brunelleschi, due to "their inappropriateness both architecturally and symbolically[,] gained many adherents." (Kremers, *op. cit.*, p. 4). Unfortunately, she names none of these adherents, and I have yet to come across any such commentary in the literature.

[81] The two freestanding crossing piers to which these friezes are attached appear to have been nearly complete in September 1443. See *Regesto* Doc. 1443c.

[82] Jacobus de Voragine, *The Golden Legend*, trans. Granger Ryan and Helmut Ripperger (New York: Arno Press, 1969), 437.

[83] George Kaftal, *Saints in Italian Art, Iconography of the Saints in Tuscan Painting* (Florence: Sansoni, 1952), 620, Episode No. 9.

[84] Antonio Manetti, *Vita di Filippo Brunelleschi*, Giuliano Tanturli, ed., Milan, 1976, p. 111.

[85] Manetti, *Vita*, ed. Tanturli, 110.

4. The Construction History of the Fifteenth-Century Basilica of San Lorenzo: A Proposed Narrative

The basilica of San Lorenzo is one of the most intensively studied buildings in Florence (Figures 2-1 and 2-3). Today the fifteenth-century core of a large religious and funerary complex that embodies over half a millennium of architectural accretion, this basilica has attracted the sustained attention of chroniclers and historians beginning even before its completion in the 1480s due to its exceptional architectural and historical significance, and to the survival of extensive archival materials pertaining to its construction and patronage.[1] Most architectural historians agree that the basilica of San Lorenzo, which owes its present appearance primarily to Filippo Brunelleschi, constitutes the first fully-developed example of the Renaissance style. Questions remain, however, about the extent and chronology of Brunelleschi's contributions, and to what extent the old Romanesque basilica of San Lorenzo that the present one replaced (hereinafter referred to as "the old basilica") influenced the present design.

With the gradual takeover of control and construction of the church by the Medici family during the first half of the fifteenth century, the basilica marked a turn toward unprecedented scale in the history of private architectural patronage. It also became a representation of Medici influence, for the family's intricate web of alliances with other powerful families finds expression in the patronage histories of the private chapels that ring it.[2] Important questions remain here, too, regarding the patronage and construction chronologies of various chapels relative to both the demolition of the old basilica and the construction of the present one. The present study aims to answer these and other questions by considering new evidence of sets of proportions in this basilica, derived from direct observation of the building fabric, and by doing so in the context of a comprehensive reappraisal of all the evidence that scholars have previously brought to bear on the problem of the construction history of this basilica.

4.1 Methodology

The early historical narratives of the basilica of San Lorenzo include Antonio di Tuccio Manetti's *Vita di Brunelleschi* (composed c. 1486), and later works that elaborate upon it with assorted documentary references and anecdotal accounts, including those by Giorgio Vasari (1550 and 1568), Ferdinando Leopoldo del Migliore (1684) and Giuseppe Richa (1757).[3] Modern scholarship pertaining to the history of the church may be considered to have begun with Pier Nolasco Cianfogni's *Memorie istoriche* of 1804 and its two-volume continuation of 1816-17 by Domenico Moreni.[4] Although Cianfogni and Moreni's footnoting methods do not meet modern scholarly standards of verification, these studies distinguish themselves from previous works through their extensive use of church and communal archives. German scholarship dominated San Lorenzo historical research from the late nineteenth to the mid-twentieth centuries, most notably in the works of Cornelius Fabriczy (1892) and Walter and Elisabeth Paatz (1940).[5] Spurred on by two anniversary celebrations—the 600th anniversary of Brunelleschi's birth in 1977 and the millennial anniversary of the foundation of the church in 1993—later twentieth-century research into the history of the fifteenth-century basilica became an energetic international enterprise, with significant new advances in documentary research and analysis contributed most notably by Howard Burns, Caroline Elam, Isabelle Hyman, Jeffrey Ruda, Pietro Ruschi, Howard Saalman; Piero Roselli and Orietta Superichi (jointly); and Franco Borsi, Gabriele Morolli and Francesco Quinterio (jointly).[6] More recently, my studies have contributed new observation-based and documentary evidence and analysis to the study of this basilica.[7]

The extensiveness of the available primary and secondary source materials pertaining to the fifteenth-century construction history of the basilica of San Lorenzo is today both an aid and a hindrance to the advancement of our understanding of this subject. These materials, while numerous and chronologically expansive, are so widely dispersed in often hard-to-find publications, and the historical problems they pertain to so complex, that mastery of them requires a time commitment that most scholars cannot afford. Furthermore, no monographic treatment of the basilica has yet provided a sufficiently comprehensive analysis of this literature to serve as a point of departure for future research.[8]

This study presents a new chronological narrative of the fifteenth-century construction history of the basilica of San Lorenzo that hews closely to the sequence of available historical documents that directly address this topic. For ease of reference, I have transcribed these documents into a *regesto*, supplemented by later documents that internally refer to relevant earlier events, such as Manetti's *Vita* (a biography composed in the late fifteenth-century that refers to the early fifteenth-century construction).[9] This historical narrative also takes into account observation-based evidence such as measurements and proportional analysis, and selected observations made by other scholars.

The historical narrative presented in this study incorporates two recent proposals of mine that have proven contentious due, I believe, to their novelty and complexity. These proposals are, first, that the old basilica was not axially aligned with the present basilica nave as most scholars believe, and that consequently the width of the former exerted no influence over the width of the latter; and second, that most of the sets of proportions and overall spatial conception of the present basilica, including the Old Sacristy, was designed by Matteo di Bartolomeo Dolfini, the prior and *capomaestro* of the church from 1417 to about 1422, before Brunelleschi took over the latter position.[10] Since these two proposals depend on a chronologically broad range of historical data, I will address them each individually, before proceeding to the narrative. This method requires that some evidence be examined more than once in this chapter, in different contexts. The two proposals in question are quite challenging, and require a willingness on the part of the reader to devote equal attention to diagrams and measurements as to documentary evidence.

This study is based on the following three assumptions: 1) documentary evidence is accurate unless contrary evidence indicates otherwise, 2) hypothetical scenarios do not constitute historical evidence, and 3) the sets of proportions that I have identified in the basilica of San Lorenzo, though based on my interpretation of measurements and other evidence, rise to a high enough level of historical certainty to be considered genuine historical artifacts.

4.2 The Old Basilica of San Lorenzo

We know what the old basilica looked like, and its approximate location and orientation, from a detailed fifteenth-century view in the Codex Rustici of c. 1444 (Figure 4-1). This view is likely to be very accurate because it was drawn by Marco di Bartolomeo Rustici, a goldsmith, miniaturist and writer who lived in the Quartiere San Giovanni, attended San Lorenzo as his parish church, and was buried there in 1457.[11] The view depicts a small, narrow, Romanesque-style basilica with a gabled façade punctuated by a large oculus, three doors (of which only two are shown due to the angle of view) and a small arcaded portico enclosed on the sides by extensions of the basilica side walls. It had two side aisles but no physical nave chapels, and a single door in the side wall shown. Also seen in the Rustici view, in the background between the old basilica roof and the old campanile, is the dome of the Old Sacristy. Completed in 1429 (modern style), the inclusion of this dome not only provides a *terminus post quem* for the view, but an indication that the old basilica faced southeast like the present one does, and stood approximately within the site of the present nave. These observations are consistent with the way in which the old basilica is mentioned in two documents dating from 1418 and 1442. The first expresses the intention of the church prior and canons to undertake construction of a portion of the new church that would extend from the rear of the old church (*ex posteriori parte extendi*).[12] The second refers three times to an agreement by Cosimo de' Medici to begin building the new basilica behind the old one, and to continue it as far as the high altar of the old basilica (*ad altare maius antiquum*)—i.e., presumably to the back wall of the old church.[13] Thus, according to the three fifteenth-century documents consulted above (the Rustici view and the documents of 1418 and 1442), much of the new basilica was planned to rise behind the old basilica.

The Rustici view also provides essential information for recreating the floor plan of the old basilica. The careful depiction in it of seven clerestory windows—if accurate—indicates that the basilica had two arcades of six freestanding columns each, perhaps to represent the twelve apostles, much like the Romanesque-style basilicas of Ss. Apostoli (Figure 4-2a) and San Pier Scheraggio in Florence.[14] Finally, the Rustici view shows a tall, apparently *trecento* campanile rising behind the old basilica, terminating the right side aisle just like the campanile of Ss. Apostoli (Figures 4-1 and 4-3).[15] The two parallel vertical lines that separate the basilica from the campanile in the Rustici view can be interpreted in two ways: either a narrow gap separated the two structures, the north walls of which were coplanar, or the campanile touched the back wall of the basilica and was offset slightly to the north. Since the first interpretation seems impractical (what purpose would such a narrow gap have served?), I will assume that the old campanile touched the back of the old basilica, similar to the arrangement found at Ss. Apostoli (Figures 4-1, 4-2a-b and 4-3). The slight difference between these two possible interpretations of the Rustici campanile, however, has no significant bearing on the following analysis.

The evidence presented above, combined with other information, now enables us to reconstruct the old basilica footprint very precisely with respect to the present one. This reconstruction is a five-step process that consists of individually locating the old campanile, and all four walls of the old basilica.[16]

<u>Step 1: Locate the West Wall of the Old Basilica</u>

The former location of the west (rear) wall of the old basilica in relation to the present basilica can be determined in part from the documents of 1418 and 1442 noted above. In 1418, Prior Dolfini petitioned the signoria to cede to the church a plot of land adjacent to the existing church property in order to "remake, enlarge and beautify" (*ampliare, et pulcherrimis edificiis reformare*) the existing building.[17] Some scholars interpret the word "enlarge" (*ampliare*) in this passage as an indication that the reconstruction project was conceived as a permanent addition to the back of the old basilica.[18] Available evidence, however, indicates that both Dolfini and Brunelleschi always intended to replace the old basilica with an entirely new one, greatly enlarged and made more sumptuous with respect to the old one.

In his petition, Dolfini notes that the portion of the proposed new basilica that would exceed the length of the old basilica, including chapels and one sacristy, would "…extend from the back part [of the old basilica] in length 65 braccia, and in width 110 braccia in line with the [transept] chapels…."[19] Previous studies that correlate these specifications with existing conditions do not refer to measurements of the present basilica.[20] My new survey now enables comparison between

Dolfini's specifications and present conditions with great precision. At issue in the present discussion is Dolfini's length dimension, which I will measure within the present basilica by proceeding in an easterly direction from the back wall of the present high altar chapel (Figure 2-1), adding up the various component dimensions from my survey to arrive at a distance of exactly 65 br. (3793.3 cm), and thus, at the likely location of the former back wall of the old basilica referred to in Dolfini's petition of 1418.

The first component of this 65 br eastward measurement to consider is the thickness of the back wall of the present high altar chapel. Unfortunately, a measurement relevant to the fifteenth century cannot be recorded here, since the entire wall, with its foundation, was rebuilt in the eighteenth century.[21] In 1837 a large portion of this reconstructed wall, which separated the high altar chapel from the Cappella dei Principi was removed. Twenty years later it was largely rebuilt again to its present form that includes a central doorway, column-supported organ loft and other *pietra serena* articulations (Figure 4-4).[22] On the east side, the plinths of the nineteenth century pilasters associated with this remodeling are not only smaller than those of the fifteenth-century pilaster plinths found elsewhere in the basilica, but project from base moldings that are not found elsewhere in the basilica. On the west side of this wall the various structural components and finishes of the Cappella dei Principi add unknown thickness to the wall relative to the location of the original exterior wall surface.

Rather than incorporate a highly compromised wall thickness measurement into this analysis, I will assume that the original thickness of this wall, combined with the original projection of each pilaster plinth into the high altar chapel, measured 2 br (116.8 cm), based on observations made elsewhere in the basilica. I will conservatively assume that this estimate is accurate within 40 cm (about $\frac{2}{3}$ br.).[23] I will also assume that the eastern edges of the present nineteenth-century corner pilaster plinths today occupy the same locations as the same edges of the original fifteenth-century plinths, and I will again assume that this estimate is accurate within 40 cm (about $\frac{2}{3}$ br). As we will see, these assumed potential discrepancies have minimal bearing on the following analysis.

Starting at the northwest corner of the present high altar chapel (Figure 2-1), from the assumed original outside surface of the west wall, and proceeding to the eastern surface of the plinth of SP 39 (Fig. 2-1), the first measurement to be contributed toward our target of 65 br (3793.4 cm) is the assumed wall thickness plus the pilaster plinth projection of SP 39, 116.8 cm (2 br), as noted above. The length of the side wall of the high altar chapel, measured from the plinth of SP 39 to the plinth of CP 5 measures 1085.1 cm (18.59 br). For the plinth width of CP 5 (which is compromised)

I will enter that of CP 4, 116.8 cm (2 br). The transept depth measured plinth to plinth from CP 5 to CP 8 is 1119.7 cm (19.19 br). The plinth width of CP 8 is 116.8 cm (2 br). The plinth projection of FP 7 is 30.5 cm (0.52 br). The first nave arcade bay width measured plinth to plinth from FP 7 to Col 8 is 563.5 cm (9.66 br). The plinth width of Column 8 is 116.9 cm (2 br). The sum of the preceding measurements is: 116.8 cm + 1085.1 cm + 116.8 cm + 1119.7 cm + 116.8 cm + 30.5 cm + 563.5 cm + 116.9 cm = 3266.1 cm, or, 55.96 br. In order to arrive at 65 br, we must proceed another 527.3 cm (because 65 br = 3793.4 cm; and 3793.4 cm - 3266.1 cm = 527.3 cm, or, 9.01 br), to the location indicated by Line A_1 in Figure 4-5. This location is 38.9 cm, or about $\frac{2}{3}$ br, west of the column plinth of Column 9.

Since I have previously shown that the entire San Lorenzo set of proportions is measured plinth to plinth, a second measurement of 65 br starting from the plinth of SP 39 (as an assumed close approximation of the original fifteenth-century plinth location) is worthy of examination, even though it raises the difficult question of whether the Florentine *signoria* would have allowed the church to build the combined thickness of the high altar chapel wall and pilaster plinths outside the boundary of the land ceded in 1418. This second measurement begins and ends 116.8 cm (2 br) east of the first one, as indicated by Line A_2 in Figure 4-5. This measurement is of particular interest because it arrives just 5 cm east of the center line that passes through both Column 9 and the wall between chapels SP 66-SP 67, and SP 67-SP 68 (Figures 2-1 and 4-5).[24]

Also relevant to this analysis is the aforementioned document of 1442. It is a notarial record of the concession of the rights of patronage of the new high altar chapel and all other parts of the new basilica “up to the old high altar” (*ad altare maius antiquum*), excluding those chapels to be built by other private citizens, to Cosimo de' Medici in exchange for his commitment to build those portions of the basilica at his own expense within six years.[25] A detailed construction ledger maintained for Cosimo between 1441 and 1452 indicates that in July 1446, six nave columns were ordered, and that on 24 October 1446, excavation for the foundations of these six columns began.[26] Between 3 February 1448 (modern style) and 31 January 1450 (modern style), numerous payments are recorded for the manufacture and delivery of all six column shafts, as well as the associated bases, capitals, entablature blocks, and arches.[27] No payments for additional columns or entablature blocks are noted in the ledger, and today a sharp break in quality between the western six columns and the eastern eight columns in the nave further indicates that the nave was built in two distinct phases (Figures 2-8 to 2-13).[28] Thus we may assume that the high altar of the old basilica stood in the vicinity of Columns 5 and 10 (Fig. 2-1), indicated by Line A_3 in Figure 4-5. The space between Line A_3 and either Lines A_1 or A_2 in Figure 4-5 can be explained by the location of the old campanile, the precise determination of which requires that we first locate the north wall of the old basilica.

Step 2: Locate the North Wall of the Old Basilica

The Rustici view shows a piazza fronting the old basilica façade and wrapping around most of the north wall (Figure 4-1). At the west end of this extended northern piazza, next to the old campanile, appears a small, irregular structure built up against the north wall of the basilica. Along the length of this wall, well above the height of this irregular structure, are four side aisle windows, perhaps indicating that additional buildings once flanked this wall, except in front of the northern side door. If so, these buildings were probably removed after the *signoria* issued a decree on 16 March 1434 (new style) ordering that an entire block of buildings in that area be demolished to create the piazza.[29] Since a public decree was required to execute the demolition, no record of the demolition has been found in the church archives, and the land to be cleared was, according to the decree, occupied by "dishonest persons" (*persone inhoneste*), we may assume that the church did not own that property.

Indeed, the north wall of the old basilica appears likely to have been built right up to the church property line (in which case either the campanile, as reconstructed in Figure 4-5, projected over the property line slightly, or the property line jogged around it). I will assume that Dolfini laid out the new basilica in such a way that the north wall of the new nave would have stood exactly where the north wall of the old nave stood, both to use church property as efficiently as possible, and to reuse the old basilica's northern foundation wall. The north wall of the *present* basilica nave, however (Figure 2-1), probably does not stand on the location that Dolfini, and Brunelleschi after him, intended it to. In order to determine the most likely location of the north wall of the old basilica, we must first reconstruct the floor plan Dolfini originally intended for the new basilica. In order to do that, we must use the footprint of the present basilica to reconstruct the floor plan that Brunelleschi originally intended, which he appears to have willingly inherited from Dolfini.

The San Lorenzo set of proportions, according to my measurements and analysis, establishes a closely approximated root-2 rectangle for the proportions of the present nave (Figure 3-4). That rectangle spans in length from the pilaster plinths attached to the two easternmost crossing piers, to those attached to the interior façade. In width it spans to the two ends of the transept, again measured plinth-to-plinth (and thus encompassing the two corner chapels, SP 12-15 and SP 60-63 in Figure 2-1). The present nave chapels are not deep enough to fill this rectangle, but they would have been had they been made approximately twice as deep as the present ones, as shown in a sketch of c. 1480 by a follower and younger contemporary of Brunelleschi, Giuliano da Sangallo (Figure 3-5).[30] Although two prominent features in this sketch, the façade portico and the series of domes (indicated by circles), appear to be Giuliano's own inventions, the deep nave chapels appear likely to reflect his inside knowledge of Brunelleschi's intentions.

According to Manetti, after Brunelleschi had taken over the post of *capomaestro* from Dolfini and Giovanni de' Medici had assumed patron-like control over the project, Giovanni was unable to find patrons for more than eight private chapels. He thus directed Brunelleschi to remove all the nave chapels that Brunelleschi had envisioned, and Brunelleschi complied "unwillingly, because it seemed to him a miserable thing…."[31] Comparing the floor plan scheme that Brunelleschi probably intended (Figure 3-5, minus Sangallo's hypothetical portico and second sacristy) with the one he was forced to accept (Figure 3-5, minus the portico, second sacristy, and deep nave chapels), we can appreciate Brunelleschi's unhappiness. Not only did the nave become spatially constricted, but the root-2 rectangle proportional framework became irrelevant (see Figure 3-4, minus the nave chapels). Manetti, for his part, appears to have been equally unhappy with the *present* nave chapels, added after 1457 (Figure 2-1).[32] His lament that "…the body of the church, from the transept downward [i.e., the nave]…although beautiful, does not conform to the aforesaid transept," implies that he, and therefore presumably Brunelleschi, would have preferred deeper and taller nave chapels to match the transept chapels.[33]

In Chapter 6, I will argue that the geometrically rigorous, deep nave chapel scheme shown in Giuliano's sketch (Figure 3-5) represented a major architectural innovation of the late fourteenth century that originated with the basilica of Santa Maria del Carmine in Pavia, which was designed by Bernardo da Venezia and begun c. 1376. I will furthermore argue that the design of this Pavian basilica exerted a significant influence over northern Italian church architecture for well over a century, including the late fourteenth-century basilica of San Petronio in Bologna, the reconstruction of the basilica of Santa Trinita in Florence during the same period, and possibly Dolfini's design for the basilica of San Lorenzo.[34] All of this evidence strongly indicates that both Dolfini and Brunelleschi intended the present basilica to be lined with deep nave chapels such as those shown in Giuliano da Sangallo's drawing. If Dolfini wanted the north wall of his new basilica to stand on the foundation of the north wall of the old basilica, therefore, he had to place the wall that formed the backs of his planned deep nave chapels along Line B in Figure 4-5 (compare with Figure 3-5).[35] Our next task is to determine exactly where along that property line, in the east-west direction, the old campanile stood (even if it exceeded that line slightly to the north, as posited above).

Step 3: Locate the Old Campanile

Although scholars have proposed several locations for the old campanile (as discussed below), documentary evidence locates it at least partially on the site of the nave chapel adjacent to the northern side door, between SP 67 and SP 68 (Figure 2-1). That location corresponds to the space formed by the intersections of Lines A_2, B, and A_3 in Figure 4-5 (though I show the campanile trespassing slightly over Line B, for reasons noted above). A marble plaque in the west wall of this chapel, dated 1760 and today partially obscured by a wooden confessional, states that in the space now occupied by this chapel the "old church bell tower once rose" (*…hic ubi campanaria vetusti temple turris adhuc assurgebat…*).[36] The plaque bears the name of the founder of the chapel, Benedetto di Antonio di Giovenco de' Medici, and the year in which he issued a codicil, 1465, directing his descendants to build this chapel in honor of S. Bernardo.[37] In that codicil Benedetto specifies that the chapel was to be like the others in design, and located "on the site where at present stands the campanile" (*et in loco, ubi de presenti est Campanile*).[38] Whether Benedetto's eighteenth-century descendants who installed this plaque had other evidence of the campanile location, in addition to this codicil, is unknown. A document of 1690, however, at least confirms the patronage of this chapel by referring to it as "the Medici Chapel next to the side door" (*la Cappella de'Medici accanto alla porta del fianco*).[39]

Further confirming that the old campanile was located on the site of the Medici chapel next to the present northern nave side door is a record of payment, dated 30 July 1448, to the stone mason Bindo di Franco for supervising the construction of 146 br of brick wall that included the "the door of the bell tower" (*po*[*r*]*ta dal campanile*); probably a reference to the present northern side door, which, as indicated by this description, appears to have once stood next to the campanile.[40] That the campanile remained standing during construction of the nearby portions of the nave throughout 1448 and 1449, and thus did not obstruct this work, is indicated by six more records of construction payment from 1449 that use the old campanile as a point of reference, as in the passages: "the arches above the round columns near the campanile," and "the big columns on the side near the campanile."[41]

Indeed, that the campanile remained standing as late as 1463 is indicated by a *sepoltuario* of that year that mentions the campanile as a point of reference for the locations of tombs in the crypt.[42] The campanile was probably demolished in 1481, and construction of the aforementioned Medici chapel on that site, envisioned since 1465, probably followed soon thereafter.[43] Additional evidence in support of my proposed location of the old campanile is presented below (under "c. 1475—June 1481: Demolition of the Old Campanile").

Step 4: Locate the Façade Wall of the Old Basilica

I have argued above that the north wall of the old basilica appears to have been built right up to the church property line, and that the originally-intended north wall of the present basilica nave, which was intended to enclose nave chapels approximately twice as deep as the present ones, was intended to be built on the foundations of the old north wall (Line B in Figure 4-5). I now similarly propose that the front façade of the present basilica very nearly marks the former location of the front of the old basilica portico (Figure 4-1). Since the horizontal, projecting striations in the present façade indicate that a formal façade incrustation was intended (Figures 4-6 and 4-7), I have drawn Line C in Figure 4-5 parallel with and 1 br east of the present façade in order to accommodate a minimum estimated thickness of the originally-intended but never-executed formal façade. Line C thus also represents my estimated location of the front edge of the portico of the old basilica.

This 1 br gap between Line C in Figure 4-5 and the present façade accommodates documentary evidence that portions of the foundation of the old basilica portico may have survived into the early sixteenth century. In December, 1516 Bacio d'Agnolo wrote to Michelangelo, who was then planning a new façade for the basilica, with the report that the weight of the new façade would require a new foundation because an old one excavated on the site, which he describes as the "foundation of the old portico" (*fondamento del porticho vechio*), was of poor quality.[44] Although Bacio's association of this foundation with the old portico is repeated in several subsequent documents written by others, another letter to Michelangelo by Andrea Ferrucci written in July 1517 reports that work on the new foundation continues slowly "…because we are finding many old walls that must be removed."[45] Thus, it seems possible that the foundation Bacio associated with the old portico in fact belonged to some other structure. Whatever the subterrannean structure in question was, the Bacio correspondence serves as an important reminder that if we are going to take the front edge of the present façade as an estimated location of the former front edge of the old portico, we must imagine the present façade thickened with the intended formal façade incrustation, and adjust our estimated old portico location accordingly, as shown by line C in Figure 4-5.[46]

Step 5: Locate the South Wall of the Old Basilica

Although no evidence of the former location of the south wall of the old basilica has yet come to light, an estimate of its location can be made from the evidence presented above pertaining to the rest of the old basilica. Since the Rustici view indicates that the old basilica resembled the extant basilica of Ss. Apostoli, we can use the floor plan of that basilica and campanile (Figure 4-2) as a likely approximation of the old basilica floor plan. First we add to the Ss. Apostoli floor plan a portico drawn to approximate the one shown in the Rustici view. Next we insert this modified Ss. Apostoli floor plan into the San Lorenzo site plan by placing the campanile on the location indicated in Figure 4-5. Finally, we adjust the scale of this plan, without altering its proportions, until it fits within the guidelines drawn in Figure 4-5. Note that this scalar adjustment, which gives us Line D in Figure 4-5, is a qualitative exercise involving no measurements. It simply attempts to determine approximately where the south wall of a basilica that resembled the basilica of Santo Apostoli would have been located had the other three walls fallen along lines A3, B and C.

The resultant floor plan provides approximate internal dimensions for the old basilica of $27\frac{1}{3}$ br (15.95 m) wide by $54\frac{2}{3}$ br (31.9 m) long, and thus suggests a Romanesque basilica of average size for Florence: the old basilica thus appears to have been approximately 40% larger in area than the basilica of Ss. Apostoli, and 50% smaller than that of San Miniato al Monte (Figures 4-2a-c).[47]

<u>The Orlando Testament</u>

The reconstruction of the old basilica shown in Figure 4-5 helps to illuminate the otherwise ambiguous architectural references in the testament of Orlando di Giovanni d'Orlandini, dated 9 October 1464. The testament provides for the maintenance of a lamp in the "church of San Lorenzo of Florence" to illuminate an image of the Virgin Mary "... situated on the second column to the right of the entrance to the said church, or at the column, which is in said church, closer by, and near the door through which one goes out and proceeds in a straight line to Via della Stufa …."[48] Athough this document does not indicate whether it refers to the old or new basilica, present site conditions indicate that it refers to the former. The present basilica does not have a door that opens "in a straight line" to Via della Stufa, but the old basilica appears to have had one.

Since according to my reconstruction the old basilica contained two arcades of six freestanding columns each, a door located at the terminus of a southerly extension of the centerline of Via della Stufa would have entered the old basilica nave between the second and third columns of the right arcade (arrow, Figure 4-8). This floor plan reconstruction is therefore consistent with the Orlando testament's description of the "second column to the right," if this passage is interpreted from the point-of-view of someone entering the old basilica through the central façade door. Other documents from 1420, 1423, 1427, 1434, 1444 and 1445 (modern style) refer to a door in the church of San Lorenzo—whether in the old or new basilica is not specified—as either opening opposite Via della Stufa, or simply as the "porta della Stufa."[49] The first four of these references could not be associated with the new basilica nave because construction of it did not begin until the 1440s.[50]

While Orlando's decision to provide for the maintenance of a lamp in a basilica that was slated for demolition might seem shortsighted, he must have had an agreement with the church to transfer the Marian image and lamp to the new basilica once it was completed. Indeed, a document of 3 August 1501 records another provision made for this image, which by then had indeed been moved to a comparable location in the new basilica. In the 1501 document the image is referred to as "Our Lady of the Column" and was located "...in the first chapel next to the porta Ambrosiana on the north side."[51] Such arrangements appear to have been common in the fifteenth century. On 21 July 1423, for example, the church granted the Rondinelli family permission to demolish its family chapel in the old basilica and to build one in a corresponding position in the new basilica, south of and adjacent to the high altar chapel.[52]

Another example of such an agreement is found in the document of 1423 noted two paragraphs above. According to it, the prior and chapter allocated to Ser Giovanni Bonaiuti a place in which to construct an altar "…in front of the door or opening that is called the door of the via della Stufa…," with a stipulation that anticipates the future construction of the new basilica on the site of the old one.[53] The stipulation provides that "…if at any time it should happen that the chapels should grow in number and it should become the case that in the said place it would be necessary that a chapel should be made similar to the others that were being made there for the ornament and enlargement of the said church…," then Buonaiuti and his heirs should be required to build such a chapel, and if they fail to do so within one year or more, the prior and canons can allocate another place in the church for this altar.[54]

The only inconsistency between: 1) my reconstruction of the old basilica presented above, 2) the various documentary references to the old basilica door that opened in line with Via della Stufa, and 3) the Rustici view, is that while the latter indeed shows a door in the north side of the old basilica, it shows it slightly too far to the west (viewer's right) for it to have both opened between the second and third columns of the north arcade, and to have been aligned with the street in question (Figures 4-1 and 4-8). I am unable to explain this discrepancy except to propose that this particular detail of the Rustici view is incorrect, and that Rustici should have drawn the door a bit farther to the east (viewer's left). With the exception of the Rustici door, this reconstruction of the old basilica location and configuration satisfies all significant constraints imposed by documentary evidence and site conditions. Although it does not address the possible differences in floor levels between the old and new basilicas, or in the street levels that originally surrounded these structures, these issues do not appear to have any significant bearing on design decisions that led to the present form of the basilica.

Previous Reconstructions of the Old Basilica

Following Saalman and Herzner, most Brunelleschi scholars over the past six decades have supported one of two configurations for the footprint of the old basilica in relation to the present one. Although the five-step reconstruction of the old basilica footprint presented above effectively refutes these proposals by identifying several historical requirements that my proposal, but no previous ones, can satisfy, the question of the location of the old basilica remains contentious.[55] Therefore, a summary of Saalman's and Herzner's positions, followed by a presentation of selected contrary evidence, is warranted.

Saalman presented his first of two proposals for the old basilica in 1958, placing the old campanile on the site of the present nave chapel adjacent to the northern side door (or, approximately where I have placed it; see Figure 4-5). In this proposal he drew the body of the old basilica as occupying the full width of the present nave, including the present nave chapels (Figure 4-9a).[56] This proposal presents a nearly square footprint for the old basilica that reflects neither the narrow proportions of the basilica shown in the Rustici view, nor of any extant Romanesque basilica in Tuscany. In 1985 Saalman revised his old basilica proposal with a partial floor plan diagram, cut off at mid-nave, showing the superimposed outlines of both the old and new basilicas. In this proposal Saalman places the old campanile in the side aisle bay immediately in front of the present northern side door, and shows the body of the old basilica occuping the width of the present nave, *excluding* the present nave chapels (Figure 4-9b).[57]

Although Saalman provides no explanation for the changes he introduced in 1985, his motivations can be inferred from information in his Brunelleschi monograph of 1993. There he reports having had a conversation in 1982 with "Professor Guglielmo Maetzke, Superintendant of Antiquities in Florence" regarding excavations made in the underchurch of San Lorenzo following the flood of 1966. During this work, Saalman claims, "the lower parts of the wall of the Romanesque campanile and perhaps a small part of the north wall of the Romanesque church were uncovered under the seventh northern (portal) chapel."[58] This wall fragment (Figure 4-10), to be discussed in detail below, lies beneath SP 66 and SP 67 (Figure 2-1). Saalman has interpreted it to be the northernmost side of a formerly square campanile foundation, as shown in his reconstruction (Figure 4-9b). Why he did not interpret it to be the *southernmost* side of such a foundation, and thus place his proposed campanile on the site of the present northern side door, is unknown.

Also unknown is why Saalman changed the width of his proposed old basilica footprint of 1958 to exclude the present nave chapels in 1985. Perhaps, after relocating his proposed old campanile as noted above (Figure 4-9b), he followed the Rustici view in making the north walls of the campanile and old basilica coplanar (Figure 4-1). Another possibility is that he followed Herzner's

1979 proposal, a source that Saalman does not cite in this context but includes in his 1993 bibliography.[59] Herzner bases his belief that the width of the old basilica matched the width of the present basilica, excluding the present nave chapels, primarily on two assumptions: first, that the new basilica project was originally conceived and executed as an addition to the back of the old basilica (based on his reading of the 1418 use of the term "enlarge" [*ampliare*] noted above); and second, that the two vertical seams in the present façade, located at the junctions of the nave chapels and side aisles (Figures 4-6 and 4-7, above the arrows), represent the outlines of the old basilica.[60] Since Herzner's complex proposal is not illustrated, it cannot be evaluated in detail. An alternative proposal for the origins of the façade seams is presented below (see "April 1465—c. 1475: Demolition of the Old Basilica…").

Subsequent scholars have repeated the proposals of Saalman and Herzner while providing little or no elaboration, but occasionally creating some confusion. In 1979 Borsi, Morolli and Quinterio presented Saalman's 1958 old basilica proposal in a series of axonometric drawings that obscure important details that might have clarified it.[61] In 1980 Roselli and Superichi presented essentially the same scheme, but reduced the width of the old basilica to exclude the present nave chapels.[62] In 1992 Elam concluded that "it is safe to assume that the old basilica corresponded in width to the present church without the side aisles…," thus aligning herself with both Herzner's proposal and Saalman's 1985 proposal; but allowed that "…in length it occupied between five and six bays of the present building," thus wavering between Saalman's 1958 and 1985 proposals.[63] In 1993 Saalman republished his partial floor plan diagrams from 1985; as did Ruschi, who also published a slightly elaborated revision of them, redrawn at full length; and Morolli reverted to Saalman's 1958 proposal.[64] In 1994, 2006 and 2007 Pacciani, Bruschi and Ruschi, respectively, again presented Saalman's 1985 proposal.[65] In 2007 Morolli republished Ruschi's 1993 floor plan drawing of Saalman's 1985 proposal, together with a cross-section drawing by Ferruccio Canali (previously published in 1993) that illustrates Saalman's 1958 proposal, even though the two proposals are incompatible with one another.[66]

Herzner's proposal of 1979 and Saalman's proposal of 1985 are supported, according to their authors, by three pieces of documentary and physical evidence, and a mass of circumstantial evidence. While counterarguments to the latter circumstantial evidence would be tedious affairs requiring far more text than the original scholars have devoted to this question, the first three pieces of evidence need to be refuted definitively here if any further progress is to be made in understanding the construction history of the basilica of San Lorenzo. Regarding these three pieces of evidence in question, first, as noted above, there is no reason to interpret the term "enlarge" (*ampliare*) used in the 1418 petition to mean that the old basilica was intended to be extended by new construction.

Second, there is no reason to interpret the present vertical façade seams as related in any way to the old basilica.[67] The third piece of evidence is the masonry fragment in the underchurch, which requires a separate discussion.

Saalman's "Foundations of Old Campanile"

Following Saalman, most San Lorenzo scholars believe that a fragment of what appears to be a medieval masonry wall containing a crudely-constructed relieving arch, located in the underchurch below the present northern side door, is a remnant of the foundation of the old basilica campanile (Figure 4-10). This theory, which Saalman has never explained in detail, evidently assumes that this old wall fragment is the northernmost of four similar walls that once formed a square directly below the aisle bay in front of the present northern side door (Figure 2-1).[68] This theory, however, is not only inconsistent with the preceding evidence regarding the location of the old campanile (see above, "Step 3: Locate the Old Campanile"), but ignores practical and structural considerations. Documents discovered by Saalman indicate that the campanile was demolished in 1481.[69] Had the campanile stood in the seventh northern aisle bay until that year, it would have obstructed circulation through both the northern side aisle and the northern side door for over three decades.[70] Furthermore, it would have impeded construction of the nave arcades and side aisle vaults. Another serious problem with Saalman's theory is that the segment of masonry wall in question does not appear to be a campanile foundation at all.

A relieving arch deflects vertical loads laterally, removing load from the ground immediately below the arch and distributing it to the sides, while adding horizontal loads. Thus, as the weight above the arch presses downward, the arch tries to spread open, pushing its feet simultaneously downward and outward. The relieving arch must therefore be buttressed on both sides either by more arches, by segments of wall of sufficient mass to counteract the lateral thrusts, or by an extensive network of piles driven into the ground beneath and to either side of the arch. It seems improbable that the builders would have found a small weak spot of earth exactly where the old campanile was to be built, surrounded by firmer earth capable of supporting a relieving arch (or perhaps four relieving arches, one in each side of the campanile foundation), and then chosen to bridge that spot with a crude relieving arch (or arches). Indeed, the irregular arch in question could have contributed instability to a tower constructed upon it by distributing the great vertical load unevenly. A relieving arch incorporated into a tower foundation thus would be more likely to have been constructed as carefully and symmetrically as any visible arches in the tower above it than to have been constructed crudely.

Dr. Rowland Mainstone, a civil and structural engineer, and a widely-respected authority on the structural behavior of historic buildings, notes with regard to the San Lorenzo arch in question: "All arches incorporated in foundations that come to mind, whether surviving built ones or ones depicted in early treatises, have circular or segmental profiles… The absence [at San Lorenzo] of any deformation of the wall consistent with that of the arch shows that the arch never had such a profile." Mainstone concludes that "…closer inspection and data on whatever else has survived…" is needed in order to determine the likelihood that "…the limited survival in the underchurch is what Howard [Saalman] identified it as being."[71] One such additional survival is another wall fragment with a similarly crude relieving arch embedded in it, a 1978 drawing of which was published in 1993 without, unfortunately, any indication of its location in the underchurch (Figure 4-11).[72] Evidently this second arch—which is clearly not the same as the first—is no longer visible. Nevertheless, its documented existence suggests the possibility that both arches, and perhaps others yet to be discovered, originally served some other function, unrelated to towers, such as water management.[73] Mainstone's provisional assessment of the masonry fragment noted by Saalman, in light of the available evidence, is that "…the masonry up to and including the arch, is indeed unlikely to have been built to serve as the base of the campanile."[74] Until some evidence comes to light indicating otherwise, I will assume that the wall fragment in question is unrelated to the old campanile.[75]

When we remove from consideration Saalman's assumption that the masonry fragment in the underchurch is a remnant of the old campanile, and Herzner's assumptions both that the façade seams are remnants of the old basilica and that in the 1418 petition "ampliare" means to build a permanent addition, we also remove any basis for the widespread scholarly assumption that the old and new basilica naves were axially aligned with one another. Liberated from these assumptions, a fresh examination of the problem of the old basilica in light of my preceding analysis favors the offset disposition for the old basilica that I have proposed (Figure 4-5 and 4-8). Another longstanding scholarly aassumption with regard to the basilica of San Lorenzo must now be relinquished if another contentious issue with regard to the basilica of San Lorenzo—the authorship question—is to be considered objectively.

4.3 The Authorship Question

Of the various unconventional results of my recent studies of the basilica of San Lorenzo, none has proven more contentious than my proposal that "…the design of the basilica of San Lorenzo, including the Old Sacristy, should hereafter be attributed equally to Matteo Dolfini *and* Filippo Brunelleschi."[76] More specifically, I have proposed that Dolfini designed most of the sets of proportions and overall three-dimensional forms of both the basilica and Old Sacristy, and that

Brunelleschi's contribution amounted to a "…grand remodeling of Dolfini's basilica design…."[77] I have simultaneously argued, however, that "…this joint attribution in no way diminishes Brunelleschi's accomplishments," because the major innovation introduced in this design, its revolutionary new Renaissance style, "…is completely of Brunelleschi's invention."[78] Some scholars have accepted my proposed joint attribution, at least as a point of departure for further discussion.[79] Others have questioned its extent, and Herzner has rejected it outright, calling Dolfini a "phantom-architect" of my own invention.[80] Although I will detail the evidence in support of my proposal below, this debate appears to be driven as much by evidence as by widespread preconceptions about the nature of Brunelleschi's design achievements. Equally important as understanding the evidence pertaining to the question of authorship, therefore, is to understand that the stakes in this debate are much lower than most scholars think.

Open virtually any textbook on art and architectural history and you will find some version of a common interpretation of the basilica of San Lorenzo, sometimes including the Old Sacristy: it is beautiful—or alternatively, "harmonious"—and strikingly different in appearance from Gothic architecture because it is based on mathematical proportions (proportion-4) that specifically include a regular floor plan grid. According to this interpretation, furthermore, the view down the nave resembles an early Renaissance perspective rendering and Brunelleschi, the inventor of scientific perspective drawing, intended this effect.[81] This interpretation originates with Rudolf Wittkower's 1953 article "Brunelleschi and 'Proportion in Perspective,'" and still represents the assumption among many scholars that stylistically-specific sets of proportions create stylistically-specific beauty in architecture, the basilica of San Lorenzo being one of the most notable examples of this purported phenomenon.[82] This assumption naturally leads many scholars to the further assumption that to attribute the San Lorenzo set of proportions to Dolfini would be effectively to credit him with the co-invention of the Renaissance style; a prospect so disturbing to many scholars that it has led them to resist any transfer of authorship of the San Lorenzo set of proportions to Dolfini from Brunelleschi. None of these assumptions are necessary, however, if we adopt the alternative assumption that sets of architectural proportions have no impact on the aesthetic quality of architectural styles.

Sets of proportions appear to have served as ubiquitous tools-of-the-trade for builders and architects of the medieval and Renaissance periods that may have undergone technical development over time but that were—and are—aesthetically and stylistically neutral.[83] Indeed, that the basilica of San Lorenzo is neither laid out on a regular floor plan grid nor based on commensurable proportions as Wittkower claims San Lorenzo and all Renaissance-style buildings are, demonstrates that such sets of proportions are not necessary for the creation of architecture that *appears* orderly and rational in a Renaissance-style way.[84] Similarly, that the floor plan of Brunelleschi's basilica of Santo Spirito is based on the same set of floor plan proportions, and indeed, on a very similar floor plan, as that of the Gothic-style Cathedral of Milan further demonstrates that sets of proportions are stylistically neutral.[85] Since the aesthetic impact of Brunelleschi's architecture cannot logically result from the architect's use of sets of proportions, it must result from Brunelleschi's skill as a designer, like the aesthetic impact of any other art form.

Thus, the customary scholarly consensus that recognizes Brunelleschi as the initiator of the Renaissance style is not threatened by my proposal that Brunelleschi incorporated Dolfini's set of proportions into his design for the basilica of San Lorenzo. On the contrary, Brunelleschi's ability to adapt a preexisting design toward a dramatically new artistic end attests to the force of his creative vision and his skill as a designer. Similarly not threatened by my proposal is the majority scholarly opinion, as published to date, regarding Dolfini's contribution to the design of the basilica of San Lorenzo. Scholars have long pondered what lasting influence, if any, Brunelleschi's predecessor as *capomaestro* of the basilica of San Lorenzo, the aforementioned prior Dolfini, might have had on the design of the basilica, but a general lack of evidence has left this question unresolved.[86] Indeed, we would have no reason to believe that this former church prior was also an architect were it not for a brief passage in Manetti's *Vita* that states: "…when the church of San Lorenzo in Florence was begun by the parishioners, the then prior of the church, who was considered to have a knowledge equal to that of other architects of the time, was made *capomaestro*. He began it with brick piers…."[87]

Manetti goes on, however, to deny any contribution by Dolfini to the design of the basilica as executed. Manetti claims that after consulting with Brunelleschi, Giovanni "di Bicci" de' Medici determined that all of Dolfini's work should be "…abandoned and undone and the whole project begun anew according to one of Brunelleschi's designs."[88] Perhaps, as Manetti claims, all of Dolfini's work was destroyed when Brunelleschi took over the project. Logic and historical precedent would both seem to dictate, however, that expensive foundation work would not have been dug up and destroyed, only to be replaced by Brunelleschi, presumably in a different basilica configuration that could not have differed substantially from Dolfini's considering the site boundaries established in 1418. It would seem to follow that Brunelleschi erected certain portions of the present basilica on foundations and walls started by Dolfini; a position with which Migliore, Fabriczy, Folnesics, Zumkeller, Borsi, Battisti, Saalman, Gärtner; Morolli and Quinterio (together); and Morolli (separately) to varying degrees concur.[89]

Battisti and Saalman support this position with particular conviction. After noting that Dolfini had "already taken steps to begin the project," Battisti asserts: "…when Brunelleschi…was called in, the only variants possible were in the elevation. Saalman's suggestion that the plan of the transept was in no way due to Brunelleschi is certainly correct: everything was basically fixed…"[90] Saalman later elaborates upon this position first by arguing at length that "…the idea of a priest in charge of the building of his church seems unusual only on superficial consideration." He then proposes that Dolfini probably established the San Lorenzo transept in a form similar to those of the basilicas of Santa Croce and Santa Maria Novella, and that "Brunelleschi's subsequent intervention did not and probably could not change this situation. Innovations on his part could only be of a limited nature and insoluble design problems were inherent in the plan he found in place."[91] A minority of scholars, including Ginori Conti, Walter and Elisabeth Paatz, Sanpaolesi, Herzner, Elam and Bruschi downplay, deny or ignore any possibility of a design contribution by Dolfini.[92]

My proposed Dolfini attribution is but a logical elaboration upon the majority position. Since it would seem to go without saying that preexisting foundations would lock in the key elements of both the floor plan and the set of proportions originally associated with those foundations; and since I have identified, based on a new survey, a set of proportions in the floor plan of the basilica that corresponds to the dimensions specified in Dolfini's 1418 petition; and since there is no evidence of any Dolfini-Brunelleschi collaboration at that early date, I have previously proposed (and I elaborate below) that the set of proportions found in the floor plan must have been designed by Dolfini. Since that set of proportions virtually preordains the present nave arcade bay set of proportions (Figure 4-12), I have furthermore proposed that Dolfini designed it as well.[93] Before considering these issues pertaining to the authorship of the overall basilica in more detail, the authorship of the Old Sacristy requires special consideration.

The Old Sacristy Authorship Question

Any attempt to determine the authorship of the Old Sacristy must consider four design elements: the overall spatial conception, the set of proportions in the floor plan, the interior elevation dimensions (which may contain significant sets of proportions, though this point is not clear), and the formal articulation. That the first of these elements follows the eleventh-century Baptistery of Padua is virtually indisputable based on physical evidence.[94] Since Giovanni de' Medici held an ambassadorship to Padua in 1404, and since the Baptistery of Padua not only projects very publicly from the front of the cathedral but is dedicated to San Giovanni, the patron saint of Florence, Giovanni de' Medici must have been familiar with it. Furthermore, the dual liturgical and private mausoleum functions that the Baptistery of Padua served by 1404 and the similarly dualistic functions of the Old Sacristy when completed in 1429 suggest that Giovanni may deserve partial credit for authorship of the Old Sacristy by perhaps having specified the Baptistery of Padua as its model.[95]

Dolfini, as the basilica *capomaestro*, could have had the responsibility of establishing the overall form of the sacristy based on the Paduan model, which was perhaps selected by Giovanni, and integrating it with the new basilica. Although Manetti claims that while Dolfini was *capomaestro* Giovanni hired Brunelleschi to design a sacristy and a chapel, Brunelleschi's responsibility could have been limited to the formal articulations of these two basilica appendages, perhaps including the pilsters and archivolts, and the forms of the domes, vaults and sacristy lantern, all within the outlines established by Dolfini.[96] Whatever their exact responsibilities may have been, whether Dolfini or Brunelleschi traveled to Padua to record the design of the baptistery would have had little impact on the spatial conception of the Old Sacristy.

Not only is that spatial conception prefigured in the Baptistery of Padua, but the main outlines of the set of proportions in its floor plan are as well. The domed main room of the baptistery measures very nearly 19 *braccia fiorentine* square, plinth to plinth, and the total length including the *scarsella* measures very nearly 27 *braccia fiorentine*, similar to the corresponding dimensions of the Old Sacristy.[97] If indeed the Baptistery of Padua served as the dimensional model for the Old Sacristy, therefore, the question of whether Dolfini or Brunelleschi brought these dimensions from Padua to Florence would be of little historical consequence, for neither architect would seem to have authored them.[98] Since the crossing square of the basilica of San Lorenzo also measures nearly exactly 19 br square, Dolfini might have used the floor plan dimensions of the Baptistery of Padua as the basis for the dimensions of the Old Sacristy floor plan, the basilica crossing square, and the overall basilica set of proportions in which these elements are thoroughly integrated.[99] Alternatively, he might have arrived at the basilica dimensions independently, and derived the 19 br x 27 br Old Sacristy floor plan dimensions from them, thus coincidentally reproducing, in close approximation, the Paduan baptistery dimensions. According to either of these scenarios, by the time Brunelleschi took over as *capomaestro* he appears to have had little opportunity to exert sole and decisive control over the Old Sacristy floor plan set of proportions.

Excluding the floor plan dimensions, Brunelleschi might have determined all the other major dimensions of the Old Sacristy, which are marked in the elevations by the edges and mortar joints of the *pietra serena* articulations. Pro-Brunelleschi scholars should note, however, that these remaining dimensions do not indicate the presence of any particularly interesting geometrical or numerical relationships that might in turn indicate a strong interest on the part of their designer in crafting sets of proportions. According to my survey, the overall interior height of the sacristy measures precisely 33 br, perhaps symbolizing the Trinity.[100] The heights of the three stages within this total, $12\frac{1}{2}$ br,

$10\frac{1}{4}$ br, and $10\frac{1}{4}$ br, result from the geometrical constraints imposed by the two stacked semicircles seen in the cross-section (Figure 3-29). Working in a downward direction from the internal height of 33 br, and considering the geometrical constraints imposed by a semicircle, and by the floor plan dimensions of 19 br square plinth to plinth, the heights of the two upper stages of $10\frac{1}{4}$ br were virtually predetermined. Only minor dimensional adjustments could have been accommodated by varying the thicknesses of the *pietra serena* moldings (Figure 3-29).

The three major dimensions of the *scarsella* portal: $6\frac{1}{2}$ br, $9\frac{1}{3}$ br, and $12\frac{1}{6}$ br (Figure 3-29) betray a possible interest on the part of the architect in numerical integration with the floor plan dimensions: the sum of the integers within these dimensions is 27 (because 6 + 9 + 12 = 27), the same number that expresses the total length of the Old Sacristy in *braccia*, measured plinth to plinth. Intentional proportional order within these dimensions is furthermore implied by the fractional endings, which descend in magnitude according to a 3:2:1 ratio (or, $\frac{3}{6}, \frac{2}{6}, \frac{1}{6}$), and which add up to one, or "unity" ($\frac{1}{2} + \frac{1}{3} + \frac{1}{6} = 1$).[101] If there is more to the set of proportions in the Old Sacristy, I have not found any convincing evidence of it.[102] The preceding analysis leaves the question of the authorship of the Old Sacristy set of proportions—if an intentional set can be said to exist at all—inconclusive, with the floor plan dimensions being most likely attributable to Dolfini, perhaps following the Padua baptistery, and the elevation dimensions, to Brunelleschi.

Attribution of the fourth Old Sacristy design element under consideration—the formal articulation—is not in contention. It is the work of Brunelleschi, who could have had substantial latitude for architectural innovation even while working within Dolfini's overall design outlines. The melon dome, for example, could have been entirely Brunelleschi's contribution to the design, perhaps inserted in full compliance with a specification by Dolfini (considered here as a hypothetical possibility) that the main room of the structure be covered by a dome of semi-spherical inside profile (Figure 3-29). Likewise, the pilaster strips and other *pietra serena* articulations are essentially surface treatments that have high aesthetic impact but negligible spatial impact on the experience of the Old Sacristy.

<u>The Basilica Authorship Question: The Overall Design and Floor Plan Set of Proportions</u>

The evidence in support of a substantial Dolfini contribution to the design of the basilica proper can be grouped into two categories. The first consists of primary sources including documents, measurements, and the San Lorenzo set of proportions (here treated as an historical artifact, as noted above) that together link the present floor plan and its set of proportions to Dolfini's 1418 petition and thus, to Dolfini's tenure as *capomaestro*. The second consists of circumstantial evidence that points to Dolfini as the author of the San Lorenzo set of proportions rather than Brunelleschi. The evidence in these two categories, beginning with the primary sources, is as follows:

In the *Vita* Manetti states that Dolfini served as *capomaestro* of the basilica reconstruction project before Brunelleschi took over the post, that he began the church "with brick piers," and that all of his work was destroyed when Brunelleschi took over the post. As noted above, however, this account is most likely only partially true, for if Dolfini had erected piers he must have constructed foundations beneath them; and while some limited above-ground work might have been demolished as a concession to Brunelleschi's new aesthetic intentions, neither the church authorities nor indeed Brunelleschi, as a responsible *capomaestro*, would likely have ordered the destruction of expensive foundation work that could have been incorporated into a new design.[103] Thus, Manetti's *Vita* must be read critically if its full value as a record of historical events is to be realized.

While Manetti's claim, for example, that all of Dolfini's work was destroyed seems unlikely for the reason noted above, it can nevertheless be interpreted as lending credibility to the rest of the account. The claim seems at once an attempt to diminish Dolfini's contribution in order to enhance Brunelleschi's reputation, and an acknowledgement that Dolfini's accomplishments as *capomaestro*—a powerful word choice by Manetti to describe Dolfini's role—were too substantial to be ignored. Lending further credibility to Manetti's account, insofar as it associates the initiation of construction of the new basilica with Dolfini by name, is a deliberation of the *gonfalone del Leon d'Oro* of 1440 that notes that construction of the high altar chapel of the new church was begun in "1419, or thereabouts," by "Mattei Dolfini, then prior of the church."[104]

Indeed, the historian must remain as alert to Manetti's occasional, apparently intentional misrepresentations of historical events such as the one discussed above, as to his occasional documented errors. Thus, while Manetti confuses the names of the families that held the rights of patronage to the San Lorenzo transept chapels in his own day with those of the original holders, and confuses Cosimo de' Medici with Cosimo's father Giovanni as the initiator of construction of the basilica of San Lorenzo, such errors do not provide sufficient justification to dismiss Manetti's claim that Dolfini served as the first *capomaestro* of the new basilica, as does Herzner, for the latter claim is not contradicted by other documentary evidence.[105] A critical reading of Manetti's *Vita* strongly points to a complex joint authorship by Dolfini and Brunelleschi. Authorship, of course, is itself a concept that requires critical consideration, for we must assume that neither architect ever served in a full-time capacity as *capomaestro* of San Lorenzo. In light of their other responsibilities, both must have delegated substantial day-to-day responsibilities to surrogates.[106]

Dolfini's petition of December 1418 contains sufficient architectural and dimensional detail (as noted above) to suggest that by that date someone had completed a design for the new basilica, including a sacristy. According to Manetti that person was Dolfini, and no other documentary evidence indicates otherwise. That the petition was successful, the land was granted, and construction began according to Dolfini's plan is indicated not only by Manetti's account, but by physical evidence. We have seen that the 65 br dimension specified in the petition, measured along the length of the basilica beginning at the back of the present high altar chapel, arrives at the most likely former location of the back wall of the old basilica campanile (Figure 4-5), consistent with other evidence. That the 110 *braccia* width dimension specified in the petition also corresponds to existing conditions within about 0.7% (or about 45 cm), as shown in Figure 4-13, further indicates that construction proceeded as Dolfini intended.[107]

Documentary evidence of construction work on the new basilica between the date of Dolfini's petition of December 1418 and his apparent death within the first three months of 1422 (modern style) is limited to three documents: 1) Manetti's retrospective comment about Dolfini's construction activity, which does not include dates, 2) a record of a ground breaking ceremony held on 10 August 1421, and 3) a record of masons having stored their tools in a nearby house during excavation for unspecified portions of the basilica foundations eight days later, on 18 August 1421.[108] Just over one year later (i.e., after Dolfini's death) a flurry of documents appears (dating from September and October 1422, and May 1423) that refers to demolition of houses along Via de' Preti (Figure 4-14) to make room for unspecified transept chapels in the new basilica, and for the Old Sacristy. For example, on 23 September 1422, one document notes that "demolition is undertaken to make the new church, that is, the chapels."[109] On 1 October 1422 a house was demolished on Via de Preti "to make the sacristy."[110] A document of 21 October 1422 records payment to masons "who are making Cosimo's foundations," thereby indicating an approximate start date of construction of either the Old Sacristy, the adjacent Medici double chapel, or more likely both, as a combined project.[111] Although these documents suggest that construction of the Old Sacristy and substantial portions of the transept commenced after Dolfini's death, and therefore under Brunelleschi's supervision, the limited construction work completed under Dolfini's previous supervision appears to have decisively influenced this and all subsequent work. In order to determine how it might have done so, we must determine where in the basilica Dolfini began construction.

Of the three aforementioned records of construction activity undertaken during Dolfini's tenure as *capomaestro*, only one specifies a location: the aforementioned document of 10 August

1421 notes that the groundbreaking ceremony was held behind the old campanile, a structure that I have argued stood adjacent to the present northern side door (Figures 4-5 and 4-8). This site may have been selected merely for the convenience of the ceremony, however, and should not be assumed to be the locus of the first permanent construction work on the new basilica. Indeed, except for this ceremonial groundbreaking, documentary evidence indicates that no work on any part of the nave began until after 1442 (see below). Thus, the subsequent document of 18 August 1421 must refer to excavation work initiated eight days later somewhere in the future transept area.[112]

A logical deduction based on available documentary evidence—made in full acknowledgement of the possibility that other, undocumented events could have taken place—proceeds as follows: since no documentary evidence of construction of either the Old Sacristy or the adjacent Medici double chapel appears until October 1422, or of the allocation of patronage of any of the private transept chapels until 1423, the most likely location of Dolfini's work of 18 August 1421 is the high altar chapel (Figure 2-1).[113] Indeed, that chapel was both the liturgical focal point of the new basilica, and the only major portion of the basilica begun during the first phase of construction (1421-1428) that fell within the financial responsibility of the prior and canons of the church (presumably with the backing of the *comune*) rather than private citizens.[114] The aforementioned "brick piers" that Manetti claims Dolfini began could have been the thickened front edges of this chapel, perhaps articulated as clusters of engaged columns or colonnettes, that Brunelleschi presumably demolished down to their foundations.[115]

In light of my preceding reconstruction of the pre-1418 site conditions, the projected basilica floor plan that Dolfini intended, and the 65 br x 110 br plot of land that Dolfini requested in 1418, must have been arranged in relation to the old basilica as shown in Figure 4-15. If my analysis is correct, therefore, once Dolfini established the foundations for the new high altar chapel, Brunelleschi would have had little opportunity to redesign either the basilica floor plan or the floor plan set of proportions. The present high altar chapel measures approximately 19 br square, plinth to plinth.[116] It thus would have implied, by logical, modular extension, a 19 br x 19 br crossing square in front of it, consistent with the Cistercian-influenced basilica planning principles that were typical of late medieval church architecture in northern Italy (Figures 3-7 to 3-10).[117] Thus, as shown in Figure 4-16, once Dolfini began construction of the high altar chapel on the west side of Via de' Preti, the eastern crossing piers would have been automatically implied, 19 br to the east. Assuming that Dolfini intended the façade of his new basilica to stand on the site of the front wall of the old basilica, right next to the church property line, then the approximately 92 br length of the nave would therefore also have been automatically implied (Figure 3-10 and 4-16).[118]

Dolfini's influence appears to have extended to the major width dimensions of the basilica as well. Although Dolfini probably did not live long enough to oversee the beginning of construction of the Old Sacristy, he appears to have established its footprint on its present site nonetheless. When he began construction of the high altar chapel foundations, he established misalignments between that future chapel, the old basilica, and the boundaries of the 1418 land allocation that only the present Old Sacristy floor plan, in its present location and configuration, could resolve. Brunelleschi, it seems, had no choice but to accept this Old Sacristy design as part of the overall basilica floor plan that he inherited.

As shown in Figure 4-16, the distance between the northern boundary of the 1418 land allocation (Line E) and the location of the north wall of the old basilica, as discussed above (Line F), was large enough to accommodate a private chapel, such as the present Ginori chapel (Figure 2-1, chapel SP 52-58), projecting from the north wall of the future transept, but not much else. Line F in Figure 4-16 also marks what I have argued is the location of the north wall of Dolfini's projected nave. That wall, I have furthermore argued, would have been, according to Dolfini's plan, the back wall of a row of deep, approximately square nave chapels (Figure 4-15). Dolfini notes in his 1418 petition that the 110 br width of the requested land was to include a sacristy. If we now draw a line symmetrically opposite Line F, relative to the longitudinal centerline of the high altar chapel, the distance between the resultant new line (Line G in Figure 4-16) and the southern boundary of the 1418 land allocation (Line H in Figure 4-16) leaves exactly enough room for the present dimensions of the Old Sacristy, including wall thicknesses.[119] These observations suggest that Dolfini specified the present sacristy dimensions and transept floor plan, and that even if Brunelleschi had wanted to change these elements of the design he probably would not have been able to.

The distance between lines F and G in Figure 4-16 establishes the future transept width of 65 br, measured between pilaster plinths SP 15 and SP 60 in Figure 2-1.[120] This dimension, together with the implied crossing piers and the various observations noted above, virtually locks in the overall basilica set of proportions. It does so because, with the 65 br transept width thus established, a closely approximated root-2 rectangle measuring 65 br x 92 br superimposed over the future nave is implied (Figures 3-4, 4-15 and 4-16). This implied rectangle, in turn, implies an eight-bay nave lined with approximately square chapels, in light of the conceptual modularity of the floor plan discussed previously (Figures 3-7 to 3-10, and 4-15). Combined with the high altar chapel and crossing square dimensions of 19 br per side, and the 19 br x 27 br Old Sacristy dimensions, all discussed above, the major elements of the overall basilica set of proportions would thus have been established. Those elements include root-2 rectangles expressed in accurate, whole number approximations of Florentine *braccia*, and the set of whole number dimensions that I have termed the "65 Group" (19, 27, 38, 46, 65, 92).[121]

Perhaps the most compelling evidence that Brunelleschi incorporated Dolfini's foundations into his design for the basilica of San Lorenzo, however, comes from Brunelleschi himself. According to Manetti, Brunelleschi noted with satisfaction that with the basilica of Santo Spirito, "…it seemed to him that he had founded a church according to his intention, insofar as the arrangement of its parts was concerned."[122] This passage suggests that his only other church, that of San Lorenzo, was *not* founded according to his intention.

<u>The Basilica Authorship Question: The Nave Arcade Bay Set of Proportions</u>

If Dolfini had pre-established an approximately 92 br-long nave that logically only could have been subdivided into eight bays (Figures 3-7 to 3-10), he would seem to have virtually handed Brunelleschi the present nave arcade bay set of proportions. Simply by marking off the bays of the nave arcades with 2 br column plinths—a logical decision considering the scale of the basilica—Brunelleschi would have come to the threshold of it. By subsequently stretching each of the eight bays in each nave arcade by a mere 2.5 cm (about $\frac{1}{25}$ br), plinth to plinth, the dimensions of $9\frac{2}{3}$ and $13\frac{2}{3}$ (measured between the nearer and farther edges of adjacent column plinths, respectively) would have appeared. These dimensions would have virtually spontaneously sent up a vertical infrastructure of geometrical, numerical and arithmetical relationships that constitute the basis of the San Lorenzo nave arcade bay set of proportions (Figure 4-12).[123]

The concept of style is of no help in determining whether Dolfini or Brunelleschi was the first to extract the nave arcade bay set of proportions from the overall basilica floor plan, because the former (the nave arcade bay set of proportions) is compatible with both Brunelleschi's early Renaissance style and Dolfini's presumed preference, the late Gothic style. According to my measurements, for example, the nave arcades of the late Gothic-style basilicas of Santa Maria del Fiore (see note 85) and Santa Trinita in Florence both contain proportions that are also found in the early Renaissance-style nave arcade bays of San Lorenzo today (see Chapter 6).[124] Both styles, furthermore, are likely to contain plinths measuring 2 br-wide (or approximately so) under columns, piers or pilasters.[125] These comparisons demonstrate that Brunelleschi's change of the style of the basilica of San Lorenzo, after he replaced Dolfini as *capomaestro*, would not have prevented him from incorporating Dolfini's set of proportions into his new early Renaissance design.

While the preceding observations seem to favor Dolfini as the author of the San Lorenzo nave arcade bay set of proportions, the question remains unresolved and deserves to be, together with the vertical proportions of the Old Sacristy, the focus of the San Lorenzo authorship debate. Five additional considerations, which may be considered circumstantial evidence, favor Dolfini in this debate:

a. The missing $5\frac{2}{3}$ br dimension

The set of proportions that is tied to each bay of the San Lorenzo nave arcades is characterized by a precise interweaving of geometrical, numerical and arithmetical relationships (Figure 4-12). Equally remarkable, therefore, is a conspicuous flaw in this set of proportions: the dimension $5\frac{2}{3}$ br is missing, though the numerical logic of this set of proportions clearly seems to require it (see Chapter 2). This flaw might have been easily remedied by increasing the arch radius, currently $5\frac{1}{12}$ br (296.66 cm), by $\frac{7}{12}$ br (34 cm), or, 11.5%, through the use of slightly pointed arches (Figure 4-12). Dolfini easily could have incorporated this typical late medieval device into his design, but Brunelleschi precluded it from his because one of the defining characteristics of his new early Renaissance style was use of semi-circular arches. Brunelleschi thus demonstrates greater commitment to the semi-circular arch, an element of style, than to the nave arcade bay set of proportions, an invisible intellectual construct.

b. The Indifferent Treatment of the San Lorenzo Set of Proportions at Santo Spirito

In designing the proportions of the Santo Spirito arcade bays, Brunelleschi appears to have started with the San Lorenzo nave arcade bay set of proportions (Figure 4-12), pushed the columns closer together by $\frac{2}{3}$ br, shortened the column shafts to maintain the vertical root-2 rectangle relationship between them, reduced the semicircular arch radii accordingly, but left all other dimensions unchanged (Figure 2-50). He thereby shattered the delicate equilibrium of the San Lorenzo nave arcade bay set of proportions, and in the process showed a level of disregard for it that suggests that he did not design it. Gone are the overlapping square and root-2 rectangle (for only the root-2 rectangle remains), the dual diagon, the Boethian number progression called out by repeated fractional endings of $\frac{2}{3}$, and the number pairs that closely approximated the mathematically irrational proportions of the root-2 rectangle and dual diagon (compare Figures 4-12 and 2-50). The freedom with which Brunelleschi appears to have composed the Santo Spirito arcade bay set of proportions contrasts markedly with the meticulous attention to geometrical, numerical and arithmetical relationships evident in the San Lorenzo nave arcade bay set of proportions, and suggests that the two sets of proportions are the products of two different authors.[126]

c. The Uniqueness of the San Lorenzo Nave Arcade Bay Set of Proportions

In the Brunelleschi *oeuvre*, the San Lorenzo nave arcade bay set of proportions stands out for its high level of complexity and precision compared to other works.[127] We have seen, for example, that the arcade bays of the basilica of Santo Spirito and the cross-section of the Old Sacristy each reveal a seemingly casual attitude toward sets of proportions compared to the intellectual intensity displayed by the San Lorenzo nave arcade bay set of proportions (Figures 2-50, 3-29 and 4-12). My preliminary study of the Ospedale degli Innocenti similarly reveals apparently intentional proportional relationships that are notably less complex than those found in the San Lorenzo nave arcade bays. One logical explanation for the uniqueness of the San Lorenzo set of proportions within this *oeuvre* is a difference in authorship.

d. Time, and the Lack Thereof

The San Lorenzo nave arcade bay set of proportions appears to be an intentional product of long contemplation, rather than some geometrical and numerical accident that Dolfini unknowingly came close to creating when he laid out the overall basilica floor plan, only to leave the final discovery to Brunelleschi. Unlike Brunelleschi, Dolfini appears to have had ample time for such contemplation. When Dolfini became *capomaestro*, presumably upon his election as prior in 1417, he had been a canon of the church since 1383, a year in which a plan to reconstruct the old basilica must already have been in discussion.[128] Dolfini had previously been elected prior in 1391, though the election was promptly annulled by the Roman Curia, which appointed a replacement, Antonio del Bene.[129] Elected again in August 1417 upon the death of the subsequent Roman-appointed prior, Matteo di Cola da Rieti, Dolfini acted immediately to secure his position. In September 1417, with the papacy perhaps distracted by the Council of Constance (1414-1418), Dolfini successfully petitioned the Florentine *signoria* to place the church under comunal jurisdiction, thus severing its ancient ties to Rome.[130] In November 1417, upon Dolfini's recommendation, the Bishop of Florence approved fourteen complex new articles to the church constitution, including a provision to encourage the canons to study "the sciences" (*le scienze*)—i.e., geometry and mathematics—perhaps reflecting his own interests.[131] In December 1418, we have seen, Dolfini petitioned the *signoria* for land to accommodate a large new basilica, the design for which he had evidently already worked out in detail.

This rapid succession of momentous decisions that would bring about the comprehensive political, spiritual and physical transformation of the church is remarkable coming so soon after Dolfini's second election, though he did have twenty-six years in which to plan it.[132] A highly motivated and politically savvy prior-architect residing in a cloistered environment, focusing much or all of his attention on a single church for over two and perhaps even three decades, would seem to be conditions conducive to the design of a large basilica that included a complex set of proportions.

Conversely, when Brunelleschi became *capomaestro* of the basilica of San Lorenzo he could hardly have afforded the luxury of long contemplation of proportional arcana, a task to which, judging from the sets of proportions of his other buildings, he does not appear to have been inclined in any case. At San Lorenzo he took over an active construction site, with workmen urgently awaiting instructions, during a time when he already had numerous other commitments, most notably the construction of the cupola of Santa Maria del Fiore. Under such circumstances the complete redesign of a major basilica, including the set of proportions, was probably as infeasible as it was unnecessary. A more manageable scope of work that would have controlled costs and promoted Brunelleschi's new Renaissance style just as effectively as a complete redesign would have been to modernize Dolfini's basilica stylistically, while changing Dolfini's set of proportions and overall spatial conception as little as possible.

e. Brunelleschi's Pragmatism and Respect for Precedent

Also consistent with the possibility that Brunelleschi incorporated a nave arcade bay set of proportions designed by Dolfini into his basilica design, rather than creating a new one, is Brunelleschi's pragmatism, as indicated in his declaration, quoted by Manetti, that "… in building, only practical experience teaches that which is to be followed."[133] If indeed his predecessor had designed a set of proportions that could have been adapted to his new design intentions, the most expedient approach available to Brunelleschi would have been to use it. That Brunelleschi willingly borrowed design ideas from other recent predecessors of his is demonstrated by his apparent use of the late Gothic-style basilica of Santa Maria del Carmine in Pavia as an important inspiration for his design of the basilica of Santo Spirito.[134]

> Furthermore, that Brunelleschi respected at least one aspect of Dolfini's San Lorenzo design, and wanted to incorporate it into his own, is indicated by his strong disapproval of Giovanni de' Medici's instructions to remove all the nave chapels that he had originally intended to build.[135] As I have argued above, Brunelleschi probably intended those chapels to have deep, approximately square footprints, and he appears to have inherited this nave chapel design from Dolfini.

From the preceding analysis I conclude that while Brunelleschi may have demolished some limited portion of masonry work that Dolfini had raised above ground level during his brief tenure as *capomaestro*, Brunelleschi willingly retained most of Dolfini's overall floor plan design, including the Old Sacristy floor plan, and would have retained more (i.e., the deep nave chapels) had Giovanni de' Medici let him. I also conclude that Brunelleschi retained Dolfini's floor plan set of proportions, and probably many parts of Dolfini's set of proportions that projected vertically from the floor plan, such as the nave and transept cross-section proportions and the nave arcade bay set of proportions.[136] Brunelleschi, for his part, may have determined some or all of the key height dimensions in the Old Sacristy cross-section, and in the process may have created a set of proportions in the elevations extruded from, but not similar to, the Old Sacristy floor plan set of proportions. The latter consists of a 19 br x 27 br approximate root-2 rectangle and was probably placed there by Dolfini. (For additional discussion of Dolfini's possible authorship, see below: "December 1418—c. April 1422: High Altar Chapel Begun under Dolfini").

<u>4.4 Construction History of the Fifteenth-Century Basilica</u>

In order to tie the preceding studies of the old basilica configuration and the new basilica authorship into a chronological narrative, we need to determine the site conditions in 1418, when Dolfini submitted his petition to the *signoria* for land to accommodate the new basilica. In addition to the old basilica, a cloister stood on the site that according to fourteenth-century documents housed a prior, a rector and six canons.[137] That cloister must have stood on the south side of the old basilica, since a piazza fronted the east side, another piazza was created on the north side in 1434 while the old cloister remained standing, and if the cloister had stood on the west side the *comune* would not have had to cede land to the church in 1418, measured from the west wall of the old basilica.[138] Of the five surviving fifteenth-century views of the basilica of San Lorenzo, two depict a cloister on the south side of the basilica. Whether these views variously depict the old or new cloister however, or even the old or new basilica, is uncertain due to the many problems of interpretation that they present. Since most of these views appear to be historically related to one another, and since they have never been examined as a group for evidence pertaining to the San Lorenzo site history, I will do so now before beginning the chronological narrative.[139]

The Five Fifteenth-Century Views of the Basilica(s) of San Lorenzo

The earliest and most detailed view of the site is the aforementioned Rustici view of c. 1444, drawn as part of a pilgrim's guide to Florence (Figure 4-1).[140] It depicts the old basilica and part of the Old Sacristy, but not the cloister. The other views are much smaller illustrations found in maps of Florence appended to commercially-produced manuscripts. Of them, the next three, in chronological order of production, are found in manuscripts of Ptolemy's *Cosmografia*.

Cod. Vat. Lat. 5699, according to a note inserted by the copyist, dates to 28 November 1469 and was illustrated by the painter and miniaturist Pietro del Massaio (1424-1490).[141] It shows a small, three bay-wide basilica with no transept, and a cloister on its south flank (Figure 4-17). Due to the large size of this cloister relative to the basilica, Saalman refers to it as the present cloister, which documentary evidence indicates was built from 1457-1461.[142] If that were the case, we would have to conclude that Pietro del Massaio omitted the domed transept and the first three bays of the new basilica that stood completed and consecrated behind the old basilica by 1461.[143] Such omissions would have been possible according to the conventions of pilgrims' maps such as this one, and this possibility, combined with the minuteness of the individual illustrations of buildings and monuments highlight the irregular reliability of this map as historical evidence.

Seemingly at odds with Saalman's interpretation, internal evidence suggests that much of the map depicts Florence from a time before the new cloister was completed. The cathedral, for example, is labeled Santa Reparata ("S. reparata")—a name commonly used in both official documents and vernacular conversation until the use of the formal name, Santa Maria del Fiore (as it was dedicated in 1296), was mandated by communal decree in 1412.[144] Of course, we do not know to what extent this mandate was ever followed in common practice. The cathedral cupola and its ball finial, completed in 1436 and 1471, respectively, are both depicted, thus indicating that the map was current in at least some respects. The Palazzo Medici, however, which was built between about 1446 and 1459, is not shown, though its future site is marked by a detailed depiction of the old Medici palace on Via Larga, which was given to Pierfrancesco de' Medici upon completion of the new one next to it.[145]

Perhaps, as Boffito suggests, this map was based on a prototype from about 1404-20, but received finishing touches to the cathedral shortly after completion of the associated manuscript in 1469.[146] That scenario suggests that it depicts the old basilica and old cloister of San Lorenzo. Alternatively, this map could reflect a conglomeration of notes and sketches from various sources and periods, perhaps of questionable accuracy.[147] Indeed, further complicating the interpretation of this map is the depiction of the San Lorenzo campanile, which differs from the one in the Rustici view both due to its tall spire and its location at the southwest rather than northwest corner of the basilica. In light of these problems, whether Cod. Vat. Lat. 5699 depicts the old or new cloister remains uncertain, and we must conclude that it cannot be used as a reliable source of historical evidence unless used in combination with other evidence independent of it. We may note, for example, that the single door in the cloister wall, which opens to a space behind the basilica and campanile depicted in this view, is consistent with the reference to an open space behind the old campanile in the aforementioned description of the groundbreaking ceremony of 10 August 1421, and thus may provide a degree of corroboration for this document.[148]

The third view, Cod. Vat. Urb. 277 (Figure 4-18), was completed in 1472 by Pietro del Massaio.[149] It depicts a church labeled San Lorenzo ("Sta. Laur.") that resembles the old basilica shown in the Rustici view due to its shed-roofed portico on the front and its flat-topped campanile at the rear, built flush with the north wall (even though Rustici appears to show it *nearly* flush). Like Cod. Vat. Lat. 5699, this view depicts a cloister flanking the south wall of the basilica, though smaller than in that view and surrounded by a wall that is crenelated. In this map the cathedral is again labeled Santa Reparata ("Sanctae reparatae"), and includes a completed cupola with ball finial. This map, however, shows the completed Palazzo Medici (labeled "P.L. cosmae medicis") next to the palace of Pierfrancesco de' Medici (labeled "D. petri francisci bernardi de medicis"), the latter closely resembling the same palace shown in Cod. Vat. Lat. 5699. In light of this conflicting internal evidence we cannot determine whether the cloister depicted in this view represents the old one, or the new one, perhaps shown anachronistically adjacent to the old basilica. This view is primarily useful as a general corroboration of Rustici's more detailed representation of the old basilica.

The fourth view, MS Lat. 4802, dates to c. 1470-1472 and is also the work of Pietro del Massaio (Figure 4-19).[150] This view differs from all the others discussed thus far in its placement of the campanile *in front of* the north wall of the basilica. It furthermore differs from the previous two views attributed to Pietro del Massaio in that it depicts a large dome at the back of the nave, and a gabled structure projecting from behind the campanile, perpendicular to the nave. While the dome illustrated by Rustici is unquestionably that of the Old Sacristy (Figure 4-1), this one contains a line resembling a vertical rib like those of the cupola of Santa Maria del Fiore. This line, if indeed a representation of an observed feature rather than some miniaturist shorthand for any dome, could indicate that this drawing depicts the dome not of the Old Sacristy, which has no ribs, but of the present basilica dome before its eighteenth-century remodeling and enclosure.

Similarly, the gabled perpendicular structure in this view is different than the flat-roofed structure in the corresponding position in the Rustici view (which is not perpendicular to the nave), and could depict the north transept arm of the new basilica. Whether or not this view depicts the nave chapels is not clear. The double horizontal line below the aisle windows could be interpreted either as a belt course or a continuous shed roof over the nave chapels. The aisle windows, furthermore, are depicted as round-headed rectangular windows rather than oculi, as at present, but whether such an error is normal for a minature drawing such as this one is unknown. Although the portico in this view would seem to suggest that the view represents the old basilica, this portico does not span the full width of the façade as do those in the Rustici view and Cod. Vat. Urb. 277 (and possibly in Cod. Vat. Lat. 5699). Thus, rather than the old basilica portico, this feature could be a temporary portico that perhaps once fronted the present basilica. In light of the numerous uncertainties discussed here, this view may not be considered a reliable source of historical evidence unless used in combination with other evidence independent of it.

The fifth view, Cod. Vat. Lat. 491, dates to about 1480, and is part of an anonymous illustrated map appended to Poggio Bracciolini's *Storia fiorentina* (Figure 4-20).[151] Consistent with its date, this map depicts the completed cathedral, though without its campanile, and the Palazzo Medici. The basilica of San Lorenzo is shown as a three bay-wide gabled structure with neither portico nor transept, and with the campanile rising in front of the north wall, as in the preceding view. This enigmatic view thus either depicts the old basilica without its portico, or the present basilica without its transept and part of its nave. If the former, then this view omits the extensive portions of the present basilica that stood behind the old basilica by the early 1460s, as noted above. This view, therefore, like MS Lat. 4802, may not be considered a reliable source of historical evidence unless used in combination with other evidence independent of it.

Of the five views analyzed here, only the Rustici view (Figure 4-1), which was drawn by a parishioner of the church and is so detailed that it even renders the clay roof tiles in red watercolor, may be considered a reliable, if not infallible, source of historical evidence pertaining to the old basilica. None of the views provide reliable information pertaining to the old cloister. In the chronological narrative that follows I will therefore refer frequently to the Rustici view, and to the others only when they show promise for providing new historical insights when combined with other evidence.

Pre-1418: The First Two Churches of San Lorenzo

Little is known about the first church of San Lorenzo, except that it was consecrated on the present site by Saint Ambrose of Milan in 393 A.D., and that it probably served as the city's first cathedral.[152] Its memory would thus confer great prestige on all subsequent churches built over its foundations. In 1060 Pope Nicolas II consecrated the next basilica to replace it, probably the small Romanesque basilica shown in the Rustici view (Fig. 4-1). As noted above, this second basilica appears to have resembled the two contemporaneous basilicas of Ss. Apostoli and San Pier Scheraggio in Florence, both built *extra muros* like San Lorenzo (Figs. 4-2a and 4-3). By the mid-thirteenth century a cloister was built on the south side of this old basilica, hypothetically reconstructed in Figure 4-14.[153] A sacristy was added in 1300, and later in that century, a campanile (Figure 4-1).[154] From 1295 until the first decade of the fifteenth century numerous private chapels or chaplaincies were founded, which did not necessarily correspond to physical chapel spaces.[155] During this period the needs of the parish evidently began to exceed the physical limits of the basilica, for a document of 1374 refers to fundraising for the "construction of the church of San Lorenzo of Florence."[156]

In 1384 the Bishop of Florence, Angelo Acciaiuoli II, announced an indulgence to be granted to all those who made a contribution toward the "remaking in an enlarged and improved form" (*ampliare et in melius reformare*) of the church of San Lorenzo. In the same year Matteo Dolfini, the prior of the small country church of San Martino in Quona (Figure 4-21), became a canon of the church of San Lorenzo and began his rise to the positions of both prior of the church and *capomaestro* of its reconstruction project.[157]

December 1418: The Land Petition

Dolfini's aforementioned land petition of 1418 betrays glimmers of the political savvy that had earlier helped the architect-prior attain and secure his new positions of authority. Perhaps to evoke an aura of longstanding official approbation, he describes the proposed reconstruction project using a word structure similar to that of the aforementioned bishop's announcement of 1384. The requested land, he notes, would make possible the "remaking of the structure in an enlarged and more beautiful form" (*ampliare, et pulcherrimis edificiis reformare*). Furthermore, perhaps to reassure the *signoria* that its vote to obliterate a densely-populated urban neighborhood behind the old basilica would not stir public condemnation, Dolfini helpfully observes that the area was occupied by "…persons of the lowest class and less than commendable repute...for the most part foreigners"—this despite the name of the street that traversed the area, the "Street of the Priests" (*la via de Preti*).[158]

In perhaps another display of political acumen, in addition to sound building practice, Dolfini appears to have attempted to control costs by retaining as much of the old basilica complex as possible. I have argued above that Dolfini intended to reuse the northern foundation wall of the old basilica to support the back wall of the deep northern nave chapels that he had planned for his new basilica, and to reuse the old portico foundation to support the projected new façade incrustation. Similarly, Frank Salman argues that the Gothic style arcades in the cloister today are remnants of the old cloister. While my reconstruction of the old basilica and cloister indicates that both structures stood on the site of the present nave (Figure 4-15) and thus, that no portion of the old cloister could have been retained *in situ* as Salman proposes, component parts of the old cloister could have been salvaged for relocation and reuse in the present cloister. My reconstruction further suggests that Dolfini may have intended to retain the old campanile permanently by locating it within one of the projected new nave chapel bays (Figure 4-15). Thus, the locations and dimensions of the old campanile, and of some of the foundations of the old basilica, appear to have constituted critical design constraints for Dolfini's new basilica. It is not difficult to imagine Dolfini adjusting a single-line diagram of the basilica floor plan, such as the one reconstructed in Figure 3-10, in relation to a site plan of the old basilica drawn to the same scale (Figure 4-14), in order to make the old campanile fall precisely within the sixth northern nave chapel bay, and to make the northern and eastern edges of the old basilica align with the walls of the projected new basilica (Figure 4-15).[159]

<u>December 1418—c. April 1422: High Altar Chapel Begun under Dolfini</u>

Dolfini probably served as *capomaestro* of an active San Lorenzo construction site for no more than eight months (i.e., from the groundbreaking ceremony of August 1421 to his death by April 1422). During that brief time, however, he appears to have initiated property condemnation and eviction in the newly ceded land, undertaken building demolition, hired laborers and skilled craftsmen, developed a network of materials suppliers, and most importantly for this discussion, brought the construction of the high altar chapel far enough along that portions of it began to display brick piers.[160] Although we have seen that excavation for some of the foundations of the basilica was documented on 18 August 1421, no known documents mention building demolition during this period—an indication that the documentary record of construction activity on the site is probably incomplete.

According to Manetti, Brunelleschi was largely absent from Florence during the crucial period both immediately preceding and following the petition of December 1418, when we would expect many of the details of the basilica design to have been finalized. Manetti notes that Brunelleschi briefly returned to Florence from an extended stay in Rome in 1417, 1419 and 1420, and that during these visits he conferred with the *Opera* of Santa Maria del Fiore on the design of the cupola.[161] Manetti indicates neither when Brunelleschi returned to Florence permanently, nor when Giovanni de' Medici hired him to design the Old Sacristy and adjacent double chapel (as noted above). Both events perhaps occurred shortly after 1420, when Brunelleschi's presence at the cathedral *Opera* became essential. In carrying out Giovanni's design work at San Lorenzo during Dolfini's tenure as *capomaestro*, Brunelleschi, I have proposed, was constrained to work within the overall building outlines and dimensions established by Dolfini. Thus, he would have been responsible for the architectural articulations of the interiors and possibly for the designs of the vaults and domes of the Old Sacristy and adjacent double chapel.

Pro-Brunelleschi scholars might prefer to believe that Brunelleschi played a larger design role during Dolfini's tenure, and indeed, the available evidence does not preclude such a scenario. For example, during his return visits to Florence Brunelleschi could have conferred *both* with the cathedral *Opera* on the design of the cupola *and* with Dolfini on fundamental design decisions pertaining to the basilica of San Lorenzo, including the Old Sacristy. Simply because such a hypothetical collaboration cannot be disproven, however, does not constitute evidence that it occurred, and sound historical method requires that in formulating hypotheses we follow the available evidence. No available evidence indicates any significant Dolfini-Brunelleschi collaboration beyond the limited coordination of efforts required by Brunelleschi's design contributions to the Old Sacristy and adjacent double chapel, under Dolfini's supervision. Conversely, Manetti's *Vita*, a genuine fifteenth century primary source, explicitly notes that Dolfini initiated construction of the basilica as *capomaestro*, without Brunelleschi's involvement apart from the two Medici-financed appendages.

<u>April 1422—November 1429: Old Sacristy Completed and Most Transept Chapels Begun under Brunelleschi</u>

Dolfini's death between February 1422 (modern style) and April 1422 left the church both leaderless and in need of a new *capomaestro*, and Giovanni de' Medici appears to have seized the moment to assert patron-like control over the church and its reconstruction project.[162] For Giovanni, Brunelleschi was the natural choice to succeed Dolfini as *capomaestro*. He was newly famous for his work on the cathedral cupola and other projects, and he was already working on portions of the basilica (the Old Sacristy and adjacent double chapel) under Giovanni's patronage. According to Manetti, Giovanni asked Brunelleschi's opinion of the work Dolfini had completed, and Brunelleschi replied by praising it, but proposing several ways (*più modi*) in which it could be improved. Giovanni thereupon ordered Brunelleschi to proceed with one of his proposals, and to remove all of Dolfini's work—an order that in practice, we have seen, probably applied only to those above-ground portions of the work that had aesthetic implications for the new basilica. Since Brunelleschi's design would be more costly than Dolfini's, Giovanni offered to pay for the entire project if necessary, thereby commencing the gradual transformation of this important parish church into a Medici family church and mausoleum.[163]

Consistent with Brunelleschi's praise of Dolfini's design was Brunelleschi's reaction to Giovanni's subsequent order to remove all the approximately square nave chapels which, I have argued above, Brunelleschi had retained from Dolfini's design and had hoped to build (Figures 3-5 and 4-15). Perhaps Giovanni's takeover alienated many members of the parish, for Giovanni could find only enough patrons, including himself, to build eight chapels, rather than the sixteen that the parish had planned under Dolfini. According to Manetti, Brunelleschi "complied [with Giovanni's order] unwillingly, because he thought it was a miserable thing."[164] Brunelleschi perhaps objected to the removal of the nave chapels both because it made the new basilica design spatially constricted compared to the floor plan he had inherited from Dolfini, and because it disrupted Dolfini's overall floor plan set of proportions that would have fitted a chapel-lined nave into an overall root-2 rectangle (Figure 3-4).

During Brunelleschi's tenure as *capomaestro* from 1422 to probably no later than 1429 (modern style), the high altar chapel rose to a height of approximately eight *braccia*, the Old Sacristy and adjacent double chapel rose to completion as a unified Medici project, patronage was assigned to all the remaining private transept chapels except that of Luca di Marco; and construction of the chapels of the Operai, da Fortuna, della Stufa, and probably the Rondinelli and Nelli commenced (Figures 2-1 and 4-22). In 1425 most construction work on the basilica stopped due to the high communal taxation imposed to fund ongoing wars with Lucca and Milan. Only the chapel of the Operai, and Giovanni's Old Sacristy and adjacent double chapel (Figure 2-1) continued to take shape after this date.[165] In 1428 (old style), the year inscribed into the spiraling lantern cap of the Old Sacristy, Giovanni de' Medici died and was interred in regal fashion in the middle of the domed room directly below it.[166]

Giovanni's new melon-domed, sacristy-mausoleum must have been a spectacle when completed, the novelty of its interior style perhaps matched only by the strangeness of both the grand, open-air archway next to it that opened from the Medici double chapel into the open-air future transept, and the modern ruins of the various incomplete transept chapels arrayed around it (Figure 4-22). Despite the hiatus that had stopped most construction activity in 1425, Giovanni's son Cosimo de' Medici pressed on with the interior embellishment of the Old Sacristy. Giovanni's sarcophagus was completed in about 1433 by Brunelleschi's adoptive son, Andrea di Lazzaro Cavalcanti, known as "il Buggiano," probably under the supervision of Donatello. Other significant interior additions by Dontatello and Michelozzo continued to take shape into the 1440s, famously provoking Brunelleschi's ire.[167]

The completion of the Old Sacristy and adjacent Medici double chapel before any other parts of the basilica is indicated by both documentary and physical evidence.[168] A decorative, exterior terra cotta frieze depicting Laurentian gridiron and angel motifs circumscribes these two contiguous basilica appendages, but no other parts of the basilica. More striking, however, are the pilaster capitals of the Ols Sacristy and adjacent double chapel, which display a notably higher level of refinement than any other capitals in the basilica, surpassing even the very high-quality column capitals in the western three bays of the nave (Figures 2-10 and 2-12).[169] The spiraling volutes of these Brunelleschi capitals are more complex than those of any others, making three turns rather than two, and bearing elliptically-striated rather than flat inner surfaces (Figure 2-52). Further distinguishing these capitals from all others in the basilica are the naturalistic leaf fronds, and the high polish of all surfaces to a nearly metallic sheen. Some of the details of these capitals, such as the delicate vertical ridges along the leaf stems, are suggestive of metalwork and thus perhaps reflect Brunelleschi's training as a goldsmith.[170] The Brunelleschi capitals associated with the Medici double chapel, which we may assume were installed by 1429, served as uniform templates, adhered to with varying degrees of fidelity, for all the subsequent pilaster and column capitals in the basilica.[171]

Completion of the Medici double chapel also established dimensional benchmarks that locked in key aspects of the nave arcade bay set of proportions for future *capomaestri*, making it difficult to change it, had they wanted to. The springing line of the arches and vaults in this chapel projected a horizontal datum line throughout the transept and into the nave, where it would mark the tops of the future entablature blocks. This datum thus also marked the springing line of all the future minor order nave arcade arches and side aisle vaults (Figure 2-51). Since the nave arcades are not raised up on steps like the transept chapels, this springing line thus established the heights of the future nave arcade entablature blocks of $17\frac{2}{3}$ br—a key dimension in the nave arcade bay set of proportions—more than a decade before construction of these nave arcades began (Figure 4-12).[172] Whether or not he inherited the nave arcade bay set of proportions from Dolfini, therefore, by 1429 Brunelleschi appears to have virtually assured that his followers would incorporate it into the future execution of the nave arcades.

<u>March—June 1434: A Proposed Chapel Project and a New Piazza</u>

A document discovered in 1978 by Jeffrey Ruda highlights the unresolved question of how Brunelleschi communicated design specifications that were not predetermined by completed work (as were the heights of the springing lines of the future nave arches and vaults noted above). In order to see how it does so, we must consider the historical context of the document. The document reveals that on 3 June 1434, with Cosimo de' Medici in exile, a group of citizens met in the Old Sacristy to draw up a detailed design for nave chapels for the basilica. Saalman contends that "… just about every possible consideration speaks against …" attribution of this chapel project to Brunelleschi; and furthermore, that the project was promoted by "'certain people' outside the Medici circle" as a way of reasserting control over the basilica.[173] Kent counters that Saalman's "… line of speculation arises from a misunderstanding of the actual political situation obtaining in Florence three months before the Medici were recalled," since Cosimo's friends, Kent claims, tended his political affairs during his absence.[174] Gargiani, later cited by Bruschi, describes the 1434 chapel project as the work of Brunelleschi, without acknowledging Saalman's 1978 contrary view.[175] New proportional evidence now supports Saalman's view.

The 1434 document specifies that the pilaster shafts between the proposed chapels should measure $1\frac{1}{2}$ br wide, and that the spaces between them should measure $10\frac{1}{8}$ br in the clear.[176] The nave columns directly opposite them must of course have the same widths and spacings as these pilasters so that the bays of the nave arcades and side aisles would align precisely with the chapels. The column shafts today indeed measure $1\frac{1}{2}$ br wide at maximum entasis, but the spaces between them measure $10\frac{1}{6}$ br in the clear, which is the dimension produced by the nave acade bay set of proportions.[177] Had the nave chapel widths been built to the 1434 specifications ($10\frac{1}{8}$ br in the clear), and the nave arcade bays been built to their present dimensions ($10\frac{1}{6}$ br in the clear), the two would have slipped increasingly out of alignment down the length of the nave.[178]

Conversely, had both the chapels and the nave arcades been built to the $10\frac{1}{8}$ br clear dimension, as specified in the 1434 document, the plinth to plinth distances in the nave arcades would have been $9\frac{5}{8}$ br (rather than $9\frac{2}{3}$ br as at present) and the present nave arcade bay set of proportions would not exist.[179] Brunellesch appears to have intended the present nave arcade bay set of proportions to be part of his San Lorenzo design, however, because we have seen that the Medici double chapel, upon its completion in 1428 under Brunelleschi's supervision, established a horizontal datum line that determined the future nave arcade entablature block height of $17\frac{2}{3}$ br, a dimension that is integrated into the nave arcade bay set of proportions in several ways, including the fractional ending $\frac{2}{3}$.

Although the $10\frac{1}{8}$ br chapel width specified in the 1434 document conflicts with the nave arcade dimensions Brunelleschi appears to have intended, it may represent a good-faith effort on the part of the 1434 chapel planners to honor Brunelleschi's intentions, to the extent that they understood them. One possible source for the erroneous $10\frac{1}{8}$ br dimension is the clear width of the Medici chapel portal adjacent to the Old Sacristy (Figure 2-51, right), which measures 10.07 br (587.5 cm), or, about $\frac{1}{17}$ br (3.4 cm) less than $10\frac{1}{8}$ br (Figure 2-1, SP 17-SP 23).[180] The 1434 document specifies that this Medici chapel was to be used as the model for the proposed nave chapels in many details, thus demonstrating respect for the work Brunelleschi had completed. The 1434 chapel planners may have assumed that Brunelleschi intended a clear width of $10\frac{1}{8}$ br for all arched portals in the basilica, throughout the transept and nave, including that of the Medici chapel and those of all the nave chapels and nave arcade bays. Since they apparently did not simply ask Brunelleschi what his intentions were, and Brunelleschi apparently did not volunteer the information, we may assume that the 1434 chapel scheme had the approval of neither Coismo de' Medici nor Brunelleschi.

Why Brunelleschi chose to make the Medici chapel portal width approximately $10\frac{1}{8}$ br in the clear is unknown. Since this chapel is raised up three steps higher than the floor level of the nave (Figure 2-1), however, while its pilaster capitals are level with the nave column capitals, the Medici chapel portal in question could not have contained the nave arcade bay set of proportions in any case (because its pilaster shafts are too short relative to the spaces between them), and Brunelleschi was free to choose another dimension. Evidently the 1434 chapel builders had knowledge of neither these dimensional discrepancies between the Medici chapel portal and the nave arcade bays Brunelleschi intended, nor of the nave arcade bay set of proportions. Thus, Brunelleschi appears to have been able to restrict access to design information so completely that both the 1434 chapel planners and their collaborators in the church hierarchy were kept out of the loop.[181] Had they been in the loop, the 1434 document would have specified chapel widths of $10\frac{1}{6}$ br, measured in the clear between the pilaster shafts, rather than $10\frac{1}{8}$ br.

Another San Lorenzo-related design project from 1434, which unlike the 1434 chapel scheme was indeed executed, lends a measure of support to Kent's contention that Cosimo's supporters continued to look out for his interests during his exile. Thus, Kent's and Cosimo's positions may not be entirely mutually exclusive. On 16 March 1434 (modern style)—two-and-a-half months before the unsuccessful chapel planners met in the Old Sacristy—the *signoria* issued a decree ordering the demolition of a block of buildings adjacent to the north side of the old basilica. Once executed, the demolition created much of the present Piazza San Lorenzo (Figures 4-22 and 4-23). In order to justify the displacement of residents from their homes the decree notes, similar to Dolfini's petition of 1418, that the properties to be demolished were occupied by "dishonest persons" (*persone inhoneste*).[182] Two weeks later, fourteen-year-old Ugo di Lorenzo della Stufa wrote to Cosimo's son Giovanni, then in exile with his family in Venice, with news of the "beautiful piazza" that had just been created between his family's palace and the old basilica. According to Hyman, the demolition was consistent with Cosimo's long-term plans for the area. Whether or not those plans included a grand palace facing the basilica directly across the new piazza as Hyman surmises, the new piazza would have greatly increased visibility of both the old basilica and the incomplete portions of the new one behind it, as shown in Rustici's view looking across it (Figures 4-1 and 4-23).[183]

<u>March 1442—May 1456: Completion of the Transept, Crossing Dome and First Three Bays of the Nave, Probably Under Michelozzo and Antonio Manetti Ciaccheri, Consecutively</u>

Upon his return to Florence from exile on 29 September 1434, Cosimo had become absolute head of state in all but appearance, and he cultivated that appearance with care. He had little incentive to fulfill immediately his father's commitment to complete the new basilica of San Lorenzo.[184] At a time when some were predicting the financial ruin of the Florentine government due to its large expenditures on the war effort an elaborate, privately-funded building project would probably have seemed to him inopportune.[185] Furthermore, Cosimo had inherited a delicate political situation. His father, we have seen, appears to have alienated many in the parish with his assertion of control over both the church of San Lorenzo and its reconstruction project, as evidenced by his inability to secure the commitments of more than six families in the parish, in addition to his own, to build eight chapels in the new basilica—a fraction of the number of chapel-holders in the old basilica.[186] With the defeat of Duke Filippo Maria of Milan in the Battle of Anghiari in 1440, and with the cupola and campanile of the Cathedral of Florence illuminated in celebration on 11 June of that year, civic pride swelled, and according to Schevill, Cosimo's popularity and political standing seemed more secure than ever.[187] Nevertheless, if Cosimo were to complete the basilica that his father had begun, he would have to be invited to do so in a manner that would give his actions at least the appearance of public altruism.

A few months later the city's attention was directed toward the old basilica of San Lorenzo, and the fragmentary and deteriorating new basilica rising behind it, when the funeral of Cosimo's younger brother Lorenzo de' Medici was held there on 24 September 1440. The standards of the *comune* and all the guilds were on display, and Bishop di Valvi sang mass. Pope Eugenio IV, then headquartered in Florence, sent his standard and that of the church of Rome, nine of his cardinals, an unspecified number of other church representatives, and one hundred torch bearers.[188] The funeral must have caused the old basilica to virtually burst its seams, and perhaps gave new urgency to the matter of its replacement.

Just two months later, on 20 November 1440, a group of church officials and prominent citizens again gathered in the Old Sacristy to plan renewed construction of the adjacent basilica. With Cosimo again conspicuously absent, but this time under very different circumstances from those in 1434, the group drafted a deliberation that reviews the history of the building project, from Dolfini's auspicious beginnings to the then-abandoned and deteriorating state of the work, which it notes was "a source of humiliation and shame for the entire population of the parish."[189] It then exhorts the citizens of the parish to complete the high altar chapel, which had been reserved for the prior and canons to build, and thus for the public domain. The group evidently considered completion of this chapel to be the key to motivating the private patrons to finish their chapels, and thereby get the project moving again. Its public pretenses notwithstanding, however, the deliberation appears to have been carefully crafted, perhaps under Cosimo's guidance, to give Cosimo the opening he was looking for. Towards the end of the deliberation, the prior and canons declare their willingness to concede the rights of patronage of the high altar chapel to "that man or those men" in the parish who would agree to pay for its construction.[190] Cosimo was probably the only person financially capable of responding to the offer, and surely no one else would have dared try. The move had been forced upon the parish by economic necessity and now Cosimo, rather than risk the appearance of an aggressive takeover of the church as his father had done, could come to the rescue.[191]

The first documentary indication that Cosimo accepted the prior and canons' offer is found in a construction ledger maintained for him by Bartolommeo di Tommaso Sassetti between 1442 and 1453. On 24 March 1442 (modern style) Cosimo made a payment to re-open a *macigno* quarry in Trassinaia, and to begin hauling the first loads to San Lorenzo.[192] We learn more about Cosimo's agreement with the church and parish, which had soon expanded considerably from the original offer of 1440, in a notarial record of 13 August 1442. In it, the church and canons formally concede to

Cosimo, the "sole noble and respected citizen" to respond to their aforementioned offer, not only the rights of patronage to the high altar chapel, but to "the nave in the middle of the church, extending as far as the high altar of the old church." The offer was made on the condition that Cosimo complete the work within six years.[193]

The construction ledger provides a detailed record of progress made between Cosimo's reopening of the Trassinaia quarry in March 1442 (modern style), and the apparent completion of the basilica up to the high altar of the old church in 1450. Preparations began for the foundations of the two freestanding crossing piers in October and November 1442.[194] Just one month later decorative pilasters for the high altar chapel were ordered.[195] That chapel, let us recall, had already reached a height of approximately eight *braccia* before construction came to a halt in 1425, and by now had evidently reached its full height, or nearly so.[196] From April through September 1443 the freestanding crossing piers rose.[197] By 8 March 1447 construction of the roof over the high altar chapel was underway.[198] In August 1449 payment was made for parts of the large crossing arches, and in September 1451 curved stones for the crown molding at the base of the dome arrived.[199]

As for the nave, on 22 March 1446 (modern style), just twenty-four days before Brunelleschi's death, five fir timbers for models of the column shafts were ordered.[200] In July of the same year, six nave columns were ordered, and on 24 October 1446 excavation for the column foundations began.[201] Between 3 February 1448 (modern style) and 31 January 1450 (modern style), numerous payments were recorded for the manufacture and delivery of all six column shafts, as well as associated bases, capitals, entablature blocks, and arches.[202] A few of the carved entablature blocks were commissioned from the celebrated Rossellino brothers, as noted in Chapter 3.[203] As indicated in Figure 4-24, when Column 10 was erected (for column numbers, see Figure 2-1), the old basilica may have had to undergo some limited demolition and patching, and the high altar relocated within it. Similiarly, the erection of Column 5 may have necessitated some limited demolition of the old cloister. On 5 February 1450 (modern style) payment was recorded for beams, trusses, and moldings for the roof, presumably over the nave.[204] We see from the preceding documentary reconstruction that Brunelleschi, who died on 15 April 1446, could not have played any significant role in supervising the execution of the nave arcades, save for crafting the design instructions—in what form we do not know—for authorized followers to execute.[205] Indeed, Brunelleschi's involvement with the project most likely ended in 1429 (modern style) with the death of Giovanni de' Medici.

The *capomaestro* of the San Lorenzo construction project beginning in 1442 was probably Michelozzo, who Saalman describes as "Cosimo's house architect, who handled everything for Cosimo after 1434."[206] Saalman argues that the niches in the transept end walls of San Lorenzo constitute “almost a Michelozzian trademark” (Figures 2-51 and 4-25), and suggests that their insertion resulted from a continuation of the collaboration between Donatello and Michelozzo that began in the Old Sacristy in the 1430s.[207] According to Vasari, these niches once held terra cotta statues executed by Donatello that depicted the four evangelists.[208] If Donatello and Michelozzo indeed added these transept niches, then perhaps they also added the recessed rectangular fields below them, today filled with embellishments from later centuries. Whether the four doors below them, two of them false and all crowned by shell tympana, are part of Brunelleschi’s design or were added by Donatello and Michelozzo is unknown (Figures 2-51 and 4-25). Taken together, however, these niches, rectangular fields and doors create a tripartite, triumphal arch-like composition in each transept end wall that echoes the Donatello and Michelozzo-modified *scarsella* wall in the Old Sacristy (Figures 2-51, 4-24 and 4-26).[209]

To the preceding evidence pointing to Michelozzo as Brunelleschi’s successor at San Lorenzo we may add Hyman’s conclusion that after 1446 Michelozzo directed the San Lorenzo and Palazzo Medici construction projects as a joint operation. In the construction ledger Hyman observes shared accounting, supplies and labor between the two projects, and the presence at both construction sites of skilled craftsmen associated with Michelozzo.[210] The *Opera* of the Cathedral of Florence, for its part, considered Michelozzo to be a worthy successor to Brunelleschi, for in August 1446 they installed him as successor to the then-recently deceased Brunelleschi as *capomaestro* of the cathedral cupola.[211]

Brunelleschi’s one documented contribution to the design of the basilica of San Lorenzo after 1442 was of architecturally minor import, but would signal a significant shift in the function and symbolism of the basilica. Brunelleschi had originally placed the choir in the crossing, in accordance with contemporary custom.[212] Manetti tells us that once the high altar chapel was largely complete, however, which the construction ledger indicates was toward the end of Brunelleschi’s lifetime, Cosimo decided to place his tomb in the crossing instead (Figure 4-4), and to move the choir into the high altar chapel.[213] Rather than turn to Michelozzo to redesign the high altar chapel, Manetti tells us that Cosimo called upon the aging master and that “Filippo adapted it in the form it has at present.”[214] These changes, long since removed, probably entailed the construction of choir stalls in the high altar chapel, such as those shown in two sixteenth century views.[215] For the transformation of the crossing area, however, Lavin suggests that Cosimo turned to Donatello, who, according to Vasari, made “the model of the high altar and the tomb of Cosimo at its foot.”[216] This model, Lavin continues, created “a coherent and unified conception that included the choir, the high altar, the tomb of Cosimo, and the pair of bronze pulpits,” and would have evoked the Early Christian basilicas of Rome, including “San Lorenzo’s own symbolic prototype,” the basilica of San Lorenzo *fuori le* *mura*.[217] Thus, Lavin proposes, the model would have manifested an "Early Christian Renaissance at San Lorenzo."[218]

Cosimo perhaps had an additional symbolic program in mind for the transept, for in planning his burial arrangements he followed in but enlarged the footsteps of his father, who had placed his tomb in the middle of the Old Sacristy, directly below the dome, thus effectively converting that structure into his mausoleum. Now Cosimo would effectively convert the entire basilica into his mausoleum by placing his own tomb in the middle of the crossing square, directly below the crossing dome.[219]

Cosimo's presumed deadline for completion of the basilica as far as the high altar of the old church, 13 August 1448 (or, exactly six years after his formal agreement with the prior and canons of the church), appears to have passed without consequence.[220] The first nave column had only arrived from the quarry, probably in need of substantial finishing, just six months before the deadline, on 3 February 1448 (modern style).[221] The final piece of his commitment, the crossing dome, was not completed until 1456, probably under the direction of the man who most likely succeeded Michelozzo as *capomaestro* in about 1452, Antonio Manetti Ciaccheri.[222] Whatever the cause of the delay—perhaps simply an unrealistic construction schedule made back in 1442—Cosimo, judging from the consistently high quality of work found throughout the basilica west of Columns 4 and 11 (Figures 2-8, 2-10, 2-12 and 2-22), does not appear to have been particularly concerned about time. That would soon change.

<u>May 1457—August 1461: Construction of the Cloister under Antonio Manetti Ciaccheri</u>

Upon completion of the crossing dome, Cosimo was sixty-seven years old. He must have been well aware that two other prominent men of his time, his father Giovanni, and Brunelleschi, both lived to just sixty-nine. Although his formal commitment to the church had now been fulfilled, for he had completed the new basilica as far east as the high altar of the old one (even if, as noted above, the old high altar itself perhaps had to be relocated as a result), Cosimo pressed on with his patronage. One year after the church canons held a supper on 2 May 1456 for the workers who were about to close the crossing dome, they held another one, on 15 May 1457, to celebrate the "… beginning of the construction of the new cloister."[223] What work was accomplished during that year is unknown—perhaps roofing and other exterior work around the dome, and land acquisition south of the old cloister to accommodate the new cloister, though no records of any such activities have yet come to light.

Why would Cosimo, who must have been anxious to secure the completion of this basilica—his final resting place—within his lifetime, next proceed to the construction of the canons' residences rather than the remaining portions of the basilica?[224] According to the fifteenth-century biographer Vespasiano da Bisticci, when Cosimo was asked virtually this very question, "… why he began first the cloister rather than the church …," he replied that if he did not build the residences no one would, "…because there would be many who would want to build the church, but not the cloister, there being [in it] much greater prestige."[225] Site conditions, however, probably provided a more practical reason. As seen in my reconstruction of the probable situation in 1457 (Figure 4-24), the old cloister and old basilica must have occupied the future site of the eastern five bays of the new basilica nave. Rather than leave the canons homeless for a decade or more while first the new nave and then the new cloister were completed, the cloister became the next logical priority (Figure 4-27).[226]

In light of this delay, Cosimo appears to have doubted whether he would live long enough to see the completion of the basilica, which he had turned into his future mausoleum, and whether his family would be able to complete the work after his passing. Cosimo had begun to contemplate his legacy, and his outlook was gloomy. "I know that after my death…" he once said, according to Vespasiano, "… my children will be in worse condition than those of any other Florentine who has died for many years past…."[227] Cosimo had good reason to worry for the future of his family's continued wealth and prominence. He must have foreseen the impending decline of the Medici bank, for by the time of his death on 1 August 1464, de Roover writes, "… his company had passed the peak of its prosperity and was going downhill. The London branch had come to grief; other branches, too, were experiencing growing difficulties; and profits were falling off."[228]

Cosimo would be succeeded as head of the Medici bank by his son Piero who, despite his lack of training in finance, would see fit to order a survey of the family assets in order to determine, in his words, "… in how many feet of water he was standing."[229] In addition to these uncertain business prospects, during the last years of Cosimo's life, Piero's succession to the position of *de facto* head-of-state was in doubt; and indeed, the two men hardly projected an image of dynastic security. Both were bedridden much of the time, leading one of Cosimo's former supporters to call them "cold fish [*huomini freddi*] … whom illness and old age have reduced to such cowardice that they avoid anything that might cause them trouble or worry."[230] Medici foes lay in wait, with Medici power apparently resting solely on the shoulders of the ailing Cosimo. When asked to join in a conspiracy against Cosimo, Palla Strozzi noted in 1460 that such a scheme would be ill-advised, for according to Rubinstein, "… as long as Cosimo was alive, it would be impossible to get rid of him; [but] once he was dead, within a few days conditions would develop according to [his enemies'] wishes."[231] Cosimo must have heard these rumblings.

Vespasiano claims to have once heard Cosimo lament "…that one of the greatest mistakes of his life was that he did not begin to spend his wealth ten years earlier, because, knowing well the nature of his city, he was sure that within not even fifty years, no memory of himself or of his house would endure save the few monuments he might have built."[232] Might Cosimo have been thinking about San Lorenzo, which by the time the crossing dome was completed was running eight years behind schedule? Vespasiano tells us that concurrent with the church and cloister of San Lorenzo, Cosimo completed the cloister and much of the church of the Badia of Fiesole, noting: "He pushed this edifice to completion with all possible haste, always doubting that his time would be sufficient."[233] Later, according to this account, Cosimo contracted with Vespasiano himself, a noted Florentine bookseller, to create an extensive library at the Badia by arranging for the copying of manuscripts. Here too, writes Vespasiano, "… his wish was that it be completed with all possible haste, and money was no object…."[234]

Another document from this period may indicate that Cosimo was willing to explore unconventional strategies for expediting completion of the basilica. In a letter of 1 February 1459 (modern style) addressed to Giovanni di Cosimo de' Medici, the Bolognese architect Aristotile Fioravanti offers to move an unspecified campanile in Florence for a fee of 1,000 gold florins. Aristotile had earned fame in 1455 for moving a tower in Bologna over a great distance, and his assistance in Florence was solicited via a request personally delivered to him in Bologna by Pagno di Lapo Portigiani, a prominent stone carver associated with the San Lorenzo project, who will be discussed in detail below. If Aristotile's letter were indeed in reference to the old campanile of San Lorenzo, it might indicate that Cosimo considered moving the campanile as a potentially more expedient alternative to demolishing and rebuilding it. The apparent location of the campanile at that time, protruding from the northern wall of the incomplete nave (Figure 4-27) would have facilitated such a move. No such project, however, appears to have been carried out in Florence.[235]

<u>August 1461—April 1465: The Southern Nave Arcade and Southern Nave Chapels</u>

In August 1461 the cloister was finished, the high altar of the new basilica was consecrated, and in a solemn procession the sacred relics of four saints (including Saint Lawrence) were transferred to it from the old basilica.[236] Cosimo was now seventy-two, and had probably already lived longer than he had expected. The transept had taken about six years to complete; the dome, about five years; the first three bays of the nave, four years; and the cloister, just over four years. At this rate Cosimo could expect the remaining work to require another four to five years, but he perhaps knew that he would not live that long. With money apparently not yet lacking (in light of Vespasiano's preceding comment), Cosimo would seem to have had ample personal motive to proceed immediately with the completion of the nave, at an expedited pace. Indeed, the canonry and entire parish would seem to have had ample motive as well, for the newly-consecrated basilica must have had a gaping hole in the end of the soaring, incomplete nave immediately east of Columns 5 and 10 (Figures 2-1 and 4-27). Since the nave was the only part of the basilica remaining to be built after the completion of the new cloister in 1461, and since the old basilica stood in the way, we might logically expect the old basilica to have been demolished soon after the consecration of the new high altar, also in 1461. Consistent with this expectation, we have seen that Vespasiano notes: "having finished the cloister [Cosimo] commenced the continuation of the church, and finished a good portion of it before he died."[237]

Cosimo died on 1 August 1464, however, and the aforementioned testament of Orlando di Giovanni d'Orlandini, which is dated 9 October 1464, clearly indicates that the old basilica was still standing at the time of writing. Thus, Cosimo did not demolish the old basilica before he died. We have seen that the testament provides for the maintenance of a lamp in the "church of San Lorenzo of Florence" to illuminate an image of the Virgin Mary "... situated on the second column to the right of the entrance to the said church, or at the column, which is in said church, closer by, and near the door through which one goes out and proceeds in a straight line to Via della Stufa …."[238] The present basilica does not have a door located as such, nor a "second column on the right" near it, but the old basilica did, according to several documentary references to such a door, and my reconstruction of the old basilica floor plan on the site (Figures 4-5 and 4-8).[239]

There would seem to be but one way to reconcile Vespasiano's above-quoted statement that Cosimo continued construction of the new basilica soon after the completion of the cloister—which according to other evidence, noted above, took place in August 1461—and the continued existence of the old basilica in October 1464: Cosimo must have proceeded only with the remaining portion of the *southern half* of the nave, *alongside* the old basilica. Finishing the southern half of the nave before the northern half would have had the practical benefit of permitting him to leave the old basilica and its numerous private chapels undisturbed until new chapels into which some of them could be transferred were ready to receive them.[240] Proceeding as such may have provided another benefit as well.

We have seen that Cosimo appears to have been free to start construction in the southern part of the nave as soon as the new cloister was finished by 12 August 1461 (Figure 4-27). Only on 6 April 1463, however, does a church ledger record the beginning of payments by five families for construction of the southern nave chapels as a joint project "… on behalf of and for the pleasure of the venerable Cosimo de' Medici."[241] A sixth chapel on this side may have been completed during this construction campaign by a member of the Medici family (Figure 2-1).[242] The reason for the approximately twenty-month delay (12 August 1461 to 6 April 1463) in the start of construction of these chapels may be that Cosimo had difficulty assembling enough patrons to build them.[243] An indication of this difficulty is provided by a church document of April 1465 that concedes to Cosimo's son and heir, Piero de' Medici, the authority to assign patronage of the then still-unbuilt northern chapels to whomever he pleased, in order to expedite their completion. The document also notes that the southern chapels had been completed by this time (Figure 4-28).[244] Thus, by completing the southern half of the nave before the northern half, Cosimo only had the immediate challenge of finding six chapel patrons rather than twelve. As the twenty-month delay suggests, even that challenge appears to have been great.[245]

While it is possible that only the southern nave chapels were completed before Cosimo's death in Augest 1464, but none of the remaining four bays of the southern nave arcade, the limited evidence that we have pertaining to this construction phase suggests otherwise. That evidence consists of Vespasiano's claim that after completing the cloister, Cosimo "…finished a good portion of [the basilica] before he died."[246] Since construction of the southern nave chapels was not Cosimo's responsibility, and if Vespasiano's claim is correct, then the only accessible portions of the basilica that Cosimo could have proceeded with after the completion of the cloister in 1461 were the remaining bays of the southern nave arcade. For Cosimo to have seen any progress on these nave arcade bays within his lifetime, he would have to have initiated planning and construction of them soon after the completion of the cloister.

We have seen that during the construction of the first three bays of the nave in the 1440s, a year and seven months were required between the ordering of the column shafts from the quarry and the delivery of the first shafts to the construction site. Once they had arrived, furthermore, substantial work would have remained in order to finish and erect them, and to manufacture and erect the other nave arcade components such as the capitals, entablature blocks and archivolts.[247] Adding to the complexity of the undertaking were the sail vaults over the side aisles, which probably had to be erected concurrently with the archivolts of the nave arcade. Since Cosimo died exactly three years to the month after the completion of the cloister (August 1464), had he not ordered the columns and begun other preparations soon after the completion of the cloister, he would not likely have lived to see any significant work completed on the nave after the completion of the cloister, as Vespasiano claims he did. This particular detail of the nave construction chronology has important implications for our understanding of the present appearance of the basilica due to the significant differences in quality between the western three bays of the nave, which were completed in the 1440s, and the eastern five bays, which were completed in the 1460s.

We have seen that in the western three bays, the sculptural carvings that adorn the Corinthian column capitals, entablature block friezes and archivolts are executed with a high degree of naturalism and refinement (Figures 2-10 and 2-23; and 2-32, lower portion). In the eastern five bays the corresponding sculptural carvings appear both simplified in design and substantially less refined—indeed, occasionally quite crude—by comparison (Figures 2-11 and 2-27; and 2-32, upper portion).[248] My measurements of the nave arcades, furthermore, reveal extremely precise dimensional consistency among the various parts of the western three bays, but substantial irregularity in the eastern five bays.[249]

Although Morolli attributes some of the differences in appearance between these two portions of the nave to the new aesthetic preferences of the new skilled craftsmen who he assumes arrived with the change in patronage from Cosimo to Piero de' Medici after August 1464, the preceding analysis suggests that Cosimo completed *both* the first phase *and* a substantial portion of the second phase before his death in 1464, and that Piero merely finished the second phase in the same manner in which his father had started it.[250] My analysis therefore suggests that Cosimo approved the simplified designs and reduced quality of the sculptural embellishment of the second phase of the nave construction, apparently in an attempt to expedite the work and complete as much of the basilica as possible before he died. Furthermore, while Morolli may be correct that a new set of skilled workers in the 1460s brought a new aesthetic sensibility to the carved details of the nave compared to the work completed some fifteen years earlier, my analysis suggests that these aesthetic changes were not generated from the various masons on the job site but rather, by a single master mason who supervised both phases of the nave construction. Thus we seem to have the remarkable situation in which a single patron and a single construction supervisor brought about a significant mid-construction change in the quality and style of the sculptural embellishment of a major fifteenth-century basilica.

To expedite the completion of a large-scale, ongoing construction project at the behest of an anxious patron would have required considerable construction knowledge and management savvy, and the man charged with the task appears to have been the highly accomplished stonecarver (*scarpellatore*) Pagno di Lapo Portigiani.[251] A document of July 1462 describes Pagno as "*capomaestro* at San Lorenzo," a position he probably accepted following the death of the previous *capomaestro*, Antonio di Manetto Ciaccheri, in November 1461.[252] Yet Pagno's prominent role in the basilica construction project appears to have begun nearly two decades earlier, during Michelozzo's tenure as *capomaestro*. Michelozzo, as much businessman as architect, oversaw numerous construction projects simultaneously, and almost certainly put someone else in charge of day-to-day operations at San Lorenzo after construction recommenced in 1442.[253] That person appears to have been Pagno.

Hyman notes that in the 1440s Pagno served as "Michelozzo's first surrogate," and played a particularly prominent role at SS. Annunziata in Florence, where Michelozzo "… was named *capomaestro* in 1444, and where Pagno not only completed the ornately carved Tabernacle in 1448, but was allowed to take full credit for it as well."[254] In 1448 and 1449 Pagno was paid for roughing out two column capitals in a quarry at Settignano, destined either for the basilica of San Lorenzo or the Palazzo Medici.[255] His role in the latter project was so important that according to Hyman he is "…the only *scarpellatore* with an individual debit account page [in the Medici construction ledger] filled with payments for work on the Palazzo."[256] If Pagno had taken charge of the basilica construction as Michelozzo's surrogate in the 1440s, and since he was serving as *capomaestro* in his own right by July 1462, and perhaps as early as November 1461, then we must conclude that he supervised the manufacture of *both* the high quality stone carving of the western portions of the nave arcades *and* the lower quality stone carving of the eastern portions, all while under the employ of Cosimo de' Medici.

This brief portrait of Pagno di Lapo Portigiani helps explain why the eastern portions of the nave arcades display such decisively lower quality than the western portions. Pagno understood the art and business of masonry construction as well as anyone in Florence. He had personally hewn capitals from rough stone at the quarries, carved and assembled an intricate and important tabernacle, and through his close association with Michelozzo learned the business of architectural production.[257] If stonework completed under his direction, particularly for an important commission such as the basilica of San Lorenzo, displays low quality of execution, we must assume that it does so because Pagno wanted it to. Cosimo knew his time was limited, and wanted as much of the basilica as possible completed before he departed. Pagno's charge was to make it happen. Pagno knew how to expedite construction of the nave arcades while maintaining visual continuity with the earlier work by simplifying the capitals to make them easier to carve (Figures 2-12 and 2-13), by hiring *botteghe* that would produce decorative work quickly, even if inadequately-trained craftsmen had to be pressed into service (Figure 2-27), and by specifying appropriately rough levels of finish in order to help those *botteghe* meet the deadline (Figures 2-19 and 2-21).

Cosimo and Pagno's apparent decision to sacrifice quality of execution for speed of completion, while the availability of funding presumably remained constant, implies an understanding of the construction process as a three-way equation of time, quality and money that required constant balancing. As such, it reflects what Linda Elaine Neagley describes as a "major cognitive shift" that took place during the fifteenth century that was spurred in part by "…the appearance of the mechanical clock and the impact of measured time on the productivity of masons."[258] In her studies of construction projects in Rouen contemporary with Cosimo and Pagno's collaboration in Florence, Neagley finds not only that "late gothic documents are littered with efforts to resolve the conflict between conservation in costs and exuberance of style," but that time was a constant concern in construction management.[259]

Neagley notes, for example, that on 4 June 1469 the canons of Rouen Cathedral reproached a master mason for his tardiness in the completion of the tour Saint-Romain and asked him "…to renounce the superfluous ornament and the care with which the stones were being cut because they would be placed beyond view in the upper levels of the tower."[260] Neagley observes that consistent with this recommendation, at Saint-Maclou "…some of the upper pinnacles of the transept portals appear crudely fashioned when compared to lower-level counterparts."[261] As two examples of apparent efforts to save money and time, Neagley notes the development of the continuous molding of the Flamboyant style, which removed the need for foliate capitals; and by the early sixteenth-century at Saint-Maclou, the hiring out of masons exclusively on a piecework, per-contract basis.[262] Similar to these French examples, the stonework in the San Lorenzo nave that exhibits a notable drop in quality after 1461 is located high above the floor, where it is not readily visible to the casual observer; and in the construction ledger of 1441-1450, virtually all work is contracted out on a piecework basis.[263]

<u>April 1465—c. 1475: Demolition of the Old Basilica, and Construction of The Northern Nave Arcade and Northern Nave Chapels</u>

Since the above-noted document of April 1465 mentions "…the chapels that are at present built on the cloister side [of the church]…," and gives Piero de' Medici the authority to assign patronage to the northern chapels that remained to be built, I will assume (as noted above) that by this date the southern nave chapels that had been jointly begun on 6 April 1463 were completed, or nearly so.[264] The documentary evidence available from subsequent years, physical evidence, and the parameters established by the present historical narrative thus far now permit a reconstruction of the remaining progress on the nave. In September 1465 Benedetto di Antonio di Giovenco de' Medici issued a codicil directing his descendants to build a chapel on the site of the old campanile, which had not yet been demolished (Figure 4-28). In either 1475 or 1479 (scholarly descriptions of the codicil are inconsistent) a clause was added to the codicil providing for the endowment of the as yet-unbuilt chapel.[265] In September 1469 Nicolò Dante Ughi recorded a payment for the construction of a chapel in an unspecified location in the basilica that must have been in the northern side of the nave.[266]

The first record of construction work underway in the northern half of the nave is found in a testament of Francesco del fu Ubaldino Inghirami of May 1470, which provides for the reconstruction of a nave chapel that had been "…damaged by the work being undertaken in the church."[267.] Since the Inghirami chapel is the third on the left in the northern side of the nave, counting from the façade wall, the work that damaged this chapel must have been in the area of Columns 12 or 13 (Figure 2-1). Thus, Column 11 must also have been either under construction or standing by this time, and the old basilica must have been demolished. One indication that the façade wall may have been completed around this time is that the angels carved into the entablature blocks of Columns 11 and 12 appear to be the products of the same *bottega*, and to depict the same childrens' likenesses, as those of the entablature blocks of Floor Pilasters 2 and 9 mounted on the interior façade (Figures 2-1, 2-29, 2-26, 4-29 and 4-30). Since the construction ledger of 1441-1453 indicates that during the first phase of the nave construction the production of the entablature blocks kept pace with the construction of the areas of the basilica in which they were to be installed, I will assume that these entablature blocks were similarly manufactured and installed without delay, and that Columns 11 and 12, the remainder of the northern nave arcades, and the façade wall are all roughly coeval, within a few years.[268]

In light of the evidence presented above I propose that the old basilica, excluding the old campanile, was demolished in about 1465. From then until about 1475, I furthermore propose, judging both from available documentary evidence and the time that had been required to build the first three nave bays in the 1440s, much of both the northern nave arcade and side aisle were completed, and all of the northern nave chapels up to and including the Inghirami chapel, but excluding the Medici chapel that would occupy the site of the old campanile, and perhaps excluding the two easternmost northern nave chapels, were completed (Figures 4-28 and 4-31).[269] The question of whether the side aisle vaults require the nave chapels to buttress their outward thrusts will require a detailed structural analysis to resolve. Until such an analysis can be completed, I propose as a working hypothesis that the construction of those vaults could have proceeded independently of the nave chapels (though note that this possible scenario is not illustrated in Fig. 4-31). Either the vaults could have been temporarily shored up laterally until the chapels were completed, or the weight of the masonry walls above the nave chapel openings (the walls that are punctuated by oculus windows), was sufficient to counteract the vault thrusts, just as the high clerestory walls appear to counteract the lateral thrusts of the side aisle vaults toward the central nave.

By about the mid-1470s (let us say c. 1475), the main façade wall and the remaining two northern nave chapels were probably completed (Figure 4-32). As the main façade wall rose alongside the southern nave chapels, which had already been completed by 1465, the left vertical façade seam that we see today was formed (Figures 4-6 and 4-31). Since the right seam is only about two-thirds the height of the left one (Figures 4-6 and 4-7), construction of the main part of the façade wall (which fronts the nave and both side aisles) must have begun before the narrow strip of the façade wall that fronts the adjacent northern nave chapel. Once the latter was begun, being so narrow, it must have proceeded rapidly, eventually catching up with the height of the main façade wall that was rising next to it. Once the incomplete main façade wall and the narrow northern chapel façade wall reached equal heights, the subsequent stone courses began to run continuously across both walls, unifying them into a single, integrated wall structure. Thus, the right vertical seam today continues only part-way up the façade (Figures 4-14, 4-31 and 4-32). There is thus no reason to imagine the outline of the old basilica as the cause of these façade seams as Herzner proposes. Pagno, who died in 1471, could have directed much or even all of the construction of the northern nave arcade bays, the northern nave chapels, and perhaps the façade wall including its two vertical seams, but documentary evidence from the 1470s is lacking. Pagno's successor as *capomaestro* is unknown.

c. 1475—June 1481: Demolition of the Old Campanile

Construction appears to have continued above the nave arcades for several years after Pagno's death, for in 1477 Lorenzo de' Medici was granted permission to log woods belonging to the *Opera* del Duomo for the roofs of San Lorenzo, presumably over the nave.[270] In preparation for the construction of the final piece of the fifteenth-century basilica, Benedetto's nave chapel, the old campanile had to be demolished. A document of June 1481 that refers to "the roof of the bells" (*el tetto delle champane*), in addition to repairs to the basilica roof, masonry work to fill "holes in the piazza that go under the church" (*rimurare le buche di sulla piazza che va sotto la chiesa*), and a general "cleaning up" (*spazzare*) under the church seems to indicate that the campanile had just been demolished down to its foundations.[271]

The location I have proposed for the old campanile—straddling the north wall of the nave chapel adjacent to the northern side door, and projecting from the north side of the new basilica from about 1448 (when the northern side door was probably constructed) to 1481—explains how the demolished campanile could have left "holes in the piazza that go under the church," as quoted above (Figure 4-32).[272] Indeed, this 1481 reference to holes in the piazza would seem to provide strong evidence *against* Saalman's 1985 campanile proposal, for in that proposal the campanile is fully surrounded by the basilica footprint and would not have left a hole in the piazza when demolished (Figure 4-9b). My proposed campanile location is also consistent with two of the fifteenth-century basilica views discussed previously, MS Lat. 4802 (Figure 4-19) and Cod. Vat. Lat. 491 (Figure 4-20). Problematic though these views may be in some respects, as discussed previously, both of them show the campanile projecting from the north wall of the basilica—a substantial departure from the Rustici view (Figure 2-1) that may indicate that the two views in question (Figures 4-19 and Figure 4-20) depict the present basilica between 1448 and 1481, even if incompletely. Construction of Benedetto's chapel must have followed soon after the demolition of the campanile (Figures 2-1 and 4-32), for in 1484 the exterior revetment of the north walls of the basilica was applied (*acconcciare due murj*), and pavement was laid around the north side of the basilica.[273]

Thus the construction of the basilica ended with the old campanile as it appears to have begun, for this structure could not have survived as long as it did had Dolfini not used it as an initial point of reference for the layout of the new basilica, safely centering it between the side walls of one of the approximately square nave chapel bays that he originally intended (Figure 4-15). In locating the old campanile as such in relation to the new basilica, Dolfini may have been planning for its permanent incorporation into the new basilica in order to save costs, just as he appears to have done by laying out the new basilica in order to reuse as much of the old basilica foundation as possible, as discussed previously.

4.5 Conclusion to the Construction History of the Fifteenth-Century Basilica

The completion of the nave in about 1484 marked the end of the construction of the main body of the basilica of San Lorenzo that Dolfini had laid out in 1418, and that Brunelleschi and at least three subsequent *capomaestri* had brought to completion. Who first proposed a second sacristy symmetrically opposite the Old Sacristy, and when, is unknown, but there is no evidence that either Dolfini or Brunelleschi ever intended one.[274] Until about 1520 a small burial chapel in the form of an entrance corridor, constructed by Gino Ginori beginning as early as 1457, occupied the site of the present New Sacristy.[275] In about 1530 the basilica interior gained two Corinthian columns of *pietra serena* when Michelangelo transformed the interior façade to house the *Tribuna delle Reliquie* (Figures 2-1 and 2-3).[276] Despite his extensive preparations, however, Michelangelo's ambitious plans for a sumptuous exterior façade never came to fruition. In the eighteenth century Ferdinando and Giuseppe Ruggieri saved the transept from what they believed to be imminent collapse by reconstructing the high altar chapel walls and extensive portions of the basilica foundations. They also added a square dome enclosure and an ornate belfry to the exterior.[277]

Even after the death in 1743 of the Electress Palatine Anna Maria Louisa de' Medici, the last survivor of the Medici dynasty who had taken a personal interest in the basilica, the transformation of the basilica continued. In 1861 the basilica interior gained two more Corinthian columns of *pietra serena* when Gaetano Baccani redesigned the back wall of the high altar chapel, in general imitation of Michelangelo's interior façade, to contain a choir and an organ loft (Figures 2-1 and 4-4).[278] In that year Baccani also embellished the nave by carving recessed panels twenty-nine cm deep into the back walls of the nave chapels and framing them with heavy, compound concentric moldings of *pietra serena*.[279] Eighty-five years later Argan interpreted these molded panels as original components of Brunelleschi's purported efforts to create effects of perspectival illusion.[280] Another seven years later, Wittkower continued Argan's perspectival reading of the basilica in his influential article "Brunelleschi and 'Proportion in Perspective,'" based in part on his belief that the present gridded pavement pattern constitutes an original Brunelleschi design element, even while acknowledging that the basilica interior was repaved in 1886.[281]

Virtually every art and architectural history textbook published since 1953 has repeated Wittkower's interpretation of the basilica as a "metrically coherent" perspectival viewing box, and as a result, today any art historical discussion of this building that does not mention the purported aesthetic influences of proportion and perspective is rare.[282] If human perception of architecture is dependent in part on the beliefs of the viewer, then Wittkower, due to his widespread influence in shaping public and scholarly perception of this building for over six decades, deserves inclusion in the list of important San Lorenzo shapers, along with Dolfini, Brunelleschi, Michelozzo, Pagno di Lapo Portigiani, Michelangelo, the Ruggieri brothers and Baccani.

The historical analysis of the basilica of San Lorenzo that concludes here is more comprehensive than any previously attempted because it reexamines, in the form of a chronological narrative, every known document pertaining to the construction history of the basilica of San Lorenzo. It also incorporates the first new historical evidence pertaining to that construction history to be discovered in many years. That new evidence consists of the set of proportions that I have identified based on observation-based and documentary research. I have argued, in turn, that that set of proportions rises to a high enough level of historical certainty to be considered a genuine historical artifact. This new proportional evidence has led me to present:

1. new distinctions between Dolfini and Brunellechi's contributions to the design of the basilica;
2. a new reconstruction of the floor plan of Dolfini's basilica design and of the location the old basilica;
3. a new interpretion of the 1434 nave chapel proposal, and a new hypothesis that Brunelleschi was able to withold design information from the unsuccessful chapel builders;

4. new observations of both Brunelleschi's design methods and his attitudes toward theory in relation to practice; and
5. new evidence that sets of proportions have no influence on architectural aesthetics (in light of the low "stakes" of the authorship question).

I present this narrative as neither definitive in its method nor its conclusions, but rather as a framework for further discussion.

[1] For descriptions of the basilica from before its completion see Antonio Manetti, *Vita di Filippo Brunelleschi*, ed. Giuliano Tanturli (Milan: Edizioni Il Polifilo, 1976), 109; and the mid-fifteenth century comments of Flavio Biondo quoted in: Howard Burns, "Quattrocento Architecture and the Antique: Some Problems," in *Classical Influences on European Culture A.D. 500-1500: Proceedings of an International Conference Held at King's College, Cambridge, April 1969*, ed. R.R. Bolgar (Cambridge: Cambridge University Press, 1971), p. 273. For later discussions of the history of the basilica, see below.

[2] Caroline Elam, "The Site and Early Building History of Michelangelo's New Sacristy," Mitteilungen des Kunsthistorischen Institutes in Florenz 23 (1979): 161-186; and Elam, "Cosimo de' Medici and San Lorenzo," in *Cosimo 'il Vecchio' de' Medici, 1389-1464: Essays in Commemoration of the 600th Anniversary of Cosimo de' Medici's Birth*, ed. Francis Ames-Lewis (Oxford: Clarendon Press, 1992), 157-180.

[3] Manetti, *Vita*; Giorgio Vasari, *Le vite de' piu' eccellenti architetti, pittori, et scultori italiani, da cimabue insino a' tempi nostri: nell'edizione per i tipi di Lorenzo Torrentino, Firenze 1550*, ed. Luciano Bellosi and Aldo Rossi (Turin: G. Einaudi, 1986); Giorgio Vasari, *Le vite de' piu eccellenti pittori scultori e architettori*, ed. Karl Frey (Munich: G. Muller, 1911), Vol. I; Ferdinando Leopoldo del Migliore, *Firenze: Città nobilissima illustrata* (Florence: della Stella, 1684), Vol. 1; and Giuseppe Richa, *Notizie Istoriche delle chiese fiorentine : divise ne' suoi quartieri* (Florence: Pietro Gaetano Viviani, 1757), Vol. 5.

[4] Pier Nolasco Cianfogni, *Memorie istoriche dell'ambrosiana real basilica di San Lorenzo di Firenze* (Florence: Domenico Ciardetti, 1804); and Domenico Moreni, *Continuazione delle memorie istoriche dell' ambrosiana imperial basilica di S. Lorenzo di Firenze*, vol. 1 (Florence: Francesco Daddi, 1816) and vol. 2 (1817).

[5] Cornel von Fabriczy, *Filippo Brunelleschi: Sein Leben und seine Werke* (Stuttgart: J. G. Cotta, 1892); and Walter and Elisabeth Paatz, *Die Kirchen von Florenz*, vol. 2 (Frankfurt am Main: V. Klostermann, 1940), 464-593.

[6] See note 1 and: Burns, "Quattrocento Architecture," 269-287; Caroline Elam, "Bricks, Mortar and Chains," Review of Battisti, *Art History* 5 (1982), 489-497; Elam, "Il palazzo nel contesto della città: strategie urbanistiche dei Medici nel gonfalone del leon d'oro, 1415-1430," in *Il palazzo Medici Riccardi di Firenze*, ed. Giovanni Cherubini and Giovanni Fanelli (Florence: Giunti, 1990), 44-57; Isabelle Hyman, “Fifteenth Century Florentine Studies: The Palazzo Medici; and a Ledger for the Church of San Lorenzo,” New York University, Ph.D. diss., 1968 (Ann Arbor, Michigan: University

Microfilms, 1970); *idem*, "Notes and Speculations on S. Lorenzo, Palazzo Medici, and an Urban Project by Brunelleschi," *Journal of the Society of Architectural Historians* 34 (1975), 98-120; Isabelle Hyman, "Towards Rescuing the Lost Reputation of Antonio di Manetto Ciaccheri," in *Essays Presented to Myron P. Gilmore*, ed. Sergio Bertelli and Gloria Ramakus, vol. 2 (Florence: La Nuova Italia, 1978), 261-280; Isabelle Hyman, "The Venice Connection: Questions About Brunelleschi and the East," in *Florence and Venice: Comparisons and Relations, Florence and Venice, comparisons and relations : acts of two Conferences at Villa I Tatti in 1976-1977*, ed. Sergio Bertelli, Nicolai Rubinstein, and Craig Hugh Smyth (Florence: La nuova Italia, 1979-1980), vol. 1 (1978), 193-208; Jeffrey Ruda, "A 1434 Building Programme for San Lorenzo in Florence," *Burlington Magazine* 120 (1978), 358-361; Pietro Ruschi, "La Sagrestia Vecchia di San Lorenzo: per un disegno delle vicende costruttive" in *Donatello e la Sagrestia Vecchia di San Lorenzo: Temi, studi, proposte di un cantiere di restauro,* ed. Cristina Danti, Isabella Lapi Ballerini, Pietro Ruschi, and Carlo Sisi (Florence: Centro Di, 1986), 15-23; Ruschi, "Una collaborazione interrotta: Brunelleschi e Donatello nella Sagrestia Vecchia di San Lorenzo," in *Donatello-Studien*, ed. Monika Cämmerer (Munich: Bruckmann, 1989), 68-87; Ruschi, "San Lorenzo prima del Brunelleschi," in *San Lorenzo: 393-1993, L'architettura, Le vicende della fabbrica*, ed. Gabriele Morolli and Pietro Ruschi (Florence: Alinea Editrice, 1993), 37-46; Ruschi, "Un 'sepoltuario' quattrocentesco e il cantiere per la nuova cappella del magnifico in San Lorenzo," in *La Toscana al tempo di Lorenzo il Magnifico: Politica Economia Cultura Arte*, vol. 1 (Pisa : Pacini, 1996), 103-120; Ruschi, "La Sagrestia Nuova, metamorfosi di uno spazio," in *Michelangelo architetto a San Lorenzo: quattro problemi aperti*, ed. Pietro Ruschi (Florence: Mandragora, 2007), 15-49; Howard Saalman, "Filippo Brunelleschi: Capital Studies," *Art Bulletin* 40 (1958), 113-137; Saalman, "Tommaso Spinelli, Michelozzo, Manetti, and Rosselino," *Journal of the Society of Architectural Historians* 25 (1966), 151-164; Saalman, "San Lorenzo: the 1434 Chapel Project," *Burlington Magazine* 120 (1978), 361-364; Saalman, "The New Sacristy of San Lorenzo before Michelangelo," *Art Bulletin* 67 (1985), 199-228; Saalman, *Filippo Brunelleschi: The Buildings* (University Park, Pennsylvania: Pennsylvania State University Press, 1993), 106-209; Piero, Rosselli [sic.], "Brunelleschi in San Lorenzo, Contributi alla cronologia dell'edificazione," *Antichita' viva* 2 (1979), 36-43; Piero Roselli, and Orietta Superichi, *L'edificazione della Basilica di San Lorenzo: una vicenda di importanza urbanistica* (Florence: Cooperativa Editrice Universitaria, 1980); Franco Borsi, Gabriele Morolli, and Francesco Quinterio, *Brunelleschiani* (Rome: Officina Edizioni, 1979); Gabriele Morolli, "San Lorenzo da Piero a Lorenzo (1465-1480 circa)," in *San Lorenzo: 393-1993, L'architettura, Le vicende della fabbrica*, ed. Gabriele Morolli and Pietro Ruschi (Florence: Alinea Editrice, 1993), 73-80; and Morolli, "Non solo Brunelleschi: San Lorenzo nel Quattrocento," in *Alla* *riscoperta delle chiese di Firenze: 5. San Lorenzo*, ed. Timothy Verdon (Florence: Centro Di, 2007), 58-109.

[7] Matthew A. Cohen, "Ugly Little Angels: Deliberately Uneven Construction Quality in the Basilica of San Lorenzo in Florence,*" arq: Architectural Research Quarterly* 11 (2007): 276-89; Cohen, "How Much Brunelleschi? A Late Medieval Proportional System in the Basilica of San Lorenzo in Florence," *Journal of the Society of Architectural Historians* 67 (2008): 18-57; Cohen, "The Lombard Connection: Northern Influences in the Basilicas of San Lorenzo and Santo Spirito in Florence," *Annali di architettura* 21, 2009, 31-44; Cohen, "Quantification and the Medieval Mind: An Imperfect Proportional System in the Basilica of Santa Maria del Fiore in Florence," in *Some degree of happiness, Studi di storia dell'architettura in onore di Howard Burns*, ed. M. Beltramini and C. Elam (Pisa: Edizioni della Normale, 2010), 1-30; and Cohen, "Ugly Little Angels Revisited," in *Quality Out of Control: Standards for Measuring Architecture*, ed. Allison Dutoit, Juliet Odgers, and Adam Sharr (London: Routledge, 2010), 79-91. (Note that in the latter article, due to a publisher's error Figure 7.4 therein contains the correct caption but an incorrect photograph. The correct photograph should be the one shown in Figure 2-23 in the present study).

[8] Saalman's lengthy treatment of the basilica of San Lorenzo in *Brunelleschi: The Buildings* provides no new information or significant observations, exception for a few brief documentary transcriptions. Saalman, *Brunelleschi: The Buildings*, 106-209.

[9] I thank Caroline Elam for contributing *regesto* Docs 1420a, 1423f, 1427f, 1444a, 1445a and 1477a from her own archival research.

[10] Dolfini's name appears in this form in Cianfogni, *Memorie istoriche*, 183. The earliest known document in which Dolfini's name appears dates to 1422, and provides the name as *M. domino Matteo Dolfini*. Elam, "The Site and Early Building History," Doc. A, p. 184. Cianfogni cites references to Dolfini's name dating as early as 1391, but does not provide full documentary citations. Cianfogni, *Memorie istoriche*, 177–178; and *regesto* Document 1391a.

[11] Kathleen Olive, "The Codex Rustici and the Fifteenth-century Florentine Artisan," *Renaissance Studies* 23 (2009), 593, 597 and 600; and for an annotated bibliography, 595 note 2.

[12] Piero Ginori Conti, *La Basilica di S. Lorenzo di Firenze: e la famiglia Ginori* (Florence: Fondazione Ginori Conti, 1940), 235; and *regesto* Doc. 1418a.

[13] *Ibid*., 242-243; and *regesto* Doc. 1442e.

[14] The basilica of Ss. Apostoli, which is still extant, was founded in about 786 but was probably rebuilt around the eleventh century. The basilica of San Pier Scheraggio, which is today only partially preserved, was dedicated in 1068. Daniele Negri, *Chiese Romaniche in Toscana* (Pistoia: Libreria

editrice Tellini, 1978), 233; and Richard Krautheimer, "Introduction to an 'Iconography' of Mediaeval Architecture," *Journal of the Warburg and Courtauld Institutes* 5 (1942), 11.

[15] Ruschi proposes a *trecento* origin for the old campanile based on the stylistic evidence provided in the Codex Rustici view. Ruschi, "San Lorenzo prima del Brunelleschi," 38 note 14.

[16] The following argument is a refinement and an elaboration of the one I have presented in: Cohen, "Ugly Little Angels Revisited," 90 note 27. For references to directions, see "Project North" arrow in Figs. 2-1, 4-5 and subsequent site plans.

[17] Ginori Conti, *La Basilica di S. Lorenzo*, 235; and *regesto* Doc. 1418a.

[18] See, for example, Volker Herzner, "Zur Baugeschichte von San Lorenzo in Florenz," *Zeitschrift für Kunstgeschichte* 37 (1974), 93-94; and Borsi, Morolli and Quinterio, *Brunelleschiani*, 77.

[19] "Et quia ecclesie huiusmodi corpus cum cappellis, sacrestia, et aliis opportunis ex posteriori parte extendi per longitudinem debet brachiis sexaginta quinque, et per latitudinem centumdecem in ordine Cappellarum…." Ginori Conti, *La Basilica di S. Lorenzo*, 235; and *regesto* Doc. 1418a.

[20] Rosselli [sic], "Brunelleschi in San Lorenzo," 37; and Roselli and Superichi, *L'edificazione della Basilica di San Lorenzo*, 68, 133-136.

[21] See the report of 1741-1742 by the architect Ferdinando Ruggeri on the extensive restoration work he undertook on the basilica, transcribed in Roselli and Superichi, *L'edificazione della Basilica di San Lorenzo*, 54-61, 76-77; and Valerio Tesi, "La 'generosa pieta' dell'elettrice palatine: restauro e completamento della basilica laurenziana new tramonto dei Medici," in *San Lorenzo: 393-1993, L'architettura, le vicende della fabbrica*, ed. Gabriele Morolli e Pietro Ruschi (Firenze: Alinea, 1993), 26, 151-158.

[22] Valerio Tesi, "L'ottocento," in *San Lorenzo: 393-1993, L'architettura, le vicende della fabbrica*, ed. Gabriele Morolli e Pietro Ruschi (Firenze: Alinea, 1993), 163-164.

[23] For the basis of this assumption, see Chapter 3.

[24] Note that since Column 9 has a shaft diameter of 87.5 cm, and the chapel wall in question has a similar thickness, Line A2 passes through these structural elements regardless of the 40 cm (about $\frac{2}{3}$ br) assumed potential error in this measurement, as discussed above.

[25] Ginori Conti, *La Basilica di San Lorenzo*, 242-243; and *regesto* Doc. 1442e. In this document the phrase *ad altare maius antiquum* occurs three times.

[26] Hyman, "Fifteenth Century Florentine Studies," 484, 538; and *regesto* Doc. 1446f.

[27] Ibid., 496, 511, 515, 516, 538-543; Hyman, "Notes and Speculations," 117; and *regesto* Docs. 1448a-c, e, i, k, l, 1449c-i, k, l.

[28] Herzner rejects my characterization of the nave construction as having been completed in two distinct phases, but does not acknowledge the evidence of such phases provided by the construction ledger. Volker Herzner, “Letter to the Editor” and Matthew Cohen, “Matthew Cohen’s Reply,” *Journal of the Society of Architectural Historians* 67 (2008), 634-635. Later Herzner lists Hyman’s article of 1975, “Notes and Speculations,” in a footnote without ever mentioning the ledger cited by Hyman or its value as historical evidence. Volker Herzner, “How much Brunelleschi? Matthew Cohen und sein Phantom-Architekt von San Lorenzo in Florenz,” (Discussion Papers) In: *Kunstgeschichte. Open Peer Reviewed Journal* (2009), note 4, < http://www.kunstgeschichte-ejournal.net/discussion/2009/herzner> 6 June 2011.

[29] Roselli and Superchi*, L’edificazione*, 50–53; and *regesto* Doc. 1434a.

[30] Giuliano da Sangallo, “Tacuino senese,” fol. 21v, Biblioteca Comunale, Siena.

[31] “…malvolentieri, perchè gli pareva cosa misera.” Antonio Manetti, *Vita di Filippo Brunelleschi*, ed. Giuliano Tanturli (Milan: Edizioni Il Polifilo, 1976), 108.

[32] On the construction of the present nave chapels see Ginori Conti, *La Basilica di S. Lorenzo*, 72–73; Roselli and Superchi, *L'edificazione*, 104-124 and 128-129; Saalman, *Brunelleschi: The Buildings*, 439, Document 12.1; and *regesto* Docs. 1463b, 1465a-b, 1469b, 1470a, and 1479a.

[33] “e ‘l corpo della chiesa dalla croce in giù, che non è conforme alla detta croce, benché sia bella cosa, ma reca seco molti inconvenienti, e di cose necessarie allo edificio, e di mancamenti di bellezza di drento e di fuori.” Manetti, *Vita di Filippo*, ed. Tanturli, 111. This comment may also imply that Manetti objected to the sculptural reliefs in the entablature block friezes in the nave, since no comparable features appear in the transept.

[34] Cohen, “The Lombard Connection,” 31-44.

[35] According to this proposal I assume that both Dolfini and Brunelleschi believed that the foundation under the north wall of the old basilica was strong enough to support the originally-intended north wall of the proposed new basilica, which would have risen only as high as the backs of their originally-intended deep nave chapels.

[36] The full text of the plaque is as follows: MAGNIFICUS BERNARDUS MEDICES ANTONII FILIUS IUVENCI NEPOS ANNO MCCCCLXV HIC UBI CAMPANARIA VETUSTI TEMPLI TURRIS ADHUC ASSURGEBAT SPATIO SIBI IURE OPTIMO VINDICATO SACELLUM D BERNARDO DICATUM EXTRUENDUM ET CAPELLANIA AERE SUO AUGENDUM TESTAMENTO VOLUIT EIUSQUE HÆREDES PERSOLUTO TANTI MAIORIS VOTO PENES SE SOLOS ET SACELLI DOMINUM ET SACERDOTII COLLATIONEM SARTA TECTA SEMPER CONSERVARUNT ERA DE RE FRANCISCUS ET PETRUS MEDICES AVERARDI

FILII AC FUNDATORIS POSTERI MONUMENTUM POSUERE ANNO REPARATAE SALUTIS MDCCLX. I thank Eva Mussotter and Ursula Winkler for recording this transcription. The text of this plaque is published, with minor spelling changes, in Moreni, *Continuazione*, vol. 1, 120-21.

[37] *Ibid*.

[38] *Ibid*., 117 note 1; Roselli and Superchi, *L'edificazione*, 128; and *regesto* Doc. 1465b.

[39] Moreni, *Continuazione*, vol. 1, 118 note 1; and *regesto* Doc. 1465b.

[40] The rather large dimension noted in this document, 146 br, may be a reference to square *braccia* of surface area of the completed brick wall. Hyman, "Fifteenth Century Florentine Studies," 350-51, 497; and *regesto* Doc. 1448f.

[41] "…due archi dal campanile sopra le colonne tonde." *Ibid*., 543; and *regesto* Doc. 1449i; "…le colon[n]e grandi dallato di verso il campanile…," *Ibid*., 515, 543; and regesto Doc. 1449k. Cf. *Ibid*., 337, 359, 360, 516; and *regesto* Doc. 1449L.

[42] Roselli and Superchi, *L'edificazione*, 130; and *regesto* Doc. 1463a.

[43] Saalman, "The New Sacristy Before Michelangelo," 207; Saalman, *Brunelleschi: The Buildings*, 439, Documents 12.1 and 12.2; and *regesto* Doc. 1481a.

[44] Giovanni Poggi, *Il carteggio di Michelangelo*, ed. Paola Barocchi and Renzo Ristori (Florence: Sansoni, 1965), 236; and *regesto* Doc. 1516a. Cf. William E.Wallace, *Michelangelo at San Lorenzo: The Genius as Entrepreneur* (Cambridge: Cambridge University Press, 1994).

[45] Poggi, *Il carteggio di Michelangelo*, 238-240, and *regesto* Docs. 1517a-c; "… ttroviamo di mollti muri vechi che bissognia dissfarglli." *Ibid*., 292, and *regesto* Doc. 1517d.

[46] Additional research is required to determine the exact location of the church property line at the front façade, both at present and in the fifteenth and sixteenth centuries.

[47] The internal, wall to wall measurements of the Basilicas of Santi Apostoli and San Miniato al Monte indicated in Figures 4-2a and c were recorded by the author in 2005 using steel tape measures manufactured by S.E.B. and a Leica Disto laser measuring device. The basilica of San Miniato al Monte was founded in 1018, and construction presumably proceeded soon thereafter. Francesco Gurrieri, Luciano Berti and Claudio Leonardi, eds., *La Basilica di San Miniato al Monte*, (Florence: Cassa di Risparmio di Firenze, 1988), 15.

[48] The complete passage reads: "Reliquit amore Dei, et pro utilitate anime sue Ecclesie, et Capitulo Ecclesie S. Laurentii de Florentia dimidium urcei olei, hoc est, medietatem unius barilis, sive lagene olei quolibet et pro quolibet anno in perpetuum cum onere, quod Prior, et Capitulum dicte Ecclesie teneantur, et debeant continuo tenere unam lampadem ad Oraculum, et ante Figuram Virginis Marie pictam, et sitam in secunda columna a dextris in introitu dicte Ecclesie, sive in columna, que est in

dicta Ecclesia, propinquiori, et prope januam, per quam egreditur et itur recta linea in viam Stuphe, que lampas debeat continuo cum oleo retineri accensa: in hoc conscientiam Prioris, et dicti Capituli strictissime onerando ec." ("Out of the love of God, and for the utility of his soul, he left to the church and chapter of the church of S. Lorenzo of Florence one half pitcher of oil, that is, a half a barrel, or bottle of oil each and every year in perpetuity with the obligation that the Prior and Chapter of the said church should be held and must continually keep a light at the place of prayer and before the painted figure of the Virgin Mary, situated on the second column to the right of the entrance to the said church, or at the column, which is in said church, closer by, and near the door through which one goes out and proceeds in a straight line to Via della Stufa, which lamp should be kept continually replenished with oil: most strictly burdening the conscience of the prior and the said chapter in this matter.") Moreni, *Continuazione*, vol. 1, 133 n. 1; and *regesto* Doc. 1464a. In formulating the preceding translation I benefitted from the assistance of Caroline Elam, Caroline van Eck and Jack Wasserman. This translation corrects and supersedes my previous one in Cohen, "Ugly Little Angels," 286.

[49] I thank Caroline Elam for providing the following documentary references from her personal archival notes (underlines here and in note 53 are mine). 1420: reference to a fornaio "in sul chanto della via della stufa dirimpetto alla porta della chiesa" (ACSL 2408, 2r), *regesto* Doc. 1420a; 18 May 1423: The prior and chapter allocate to Ser Giovanni Bonaiuti a place "pro porta sive ianua que dicitur <u>la porta della via della stufa</u> usque ad tabernaculum nostre donne quod dicitur factum per magnificam potentiam florentinam excepto chiusuro sepulture illorum della stufa." ("in front of the door or opening which is called the door of the via della Stufa up to the tabernacle of Our Lady which [i.e. tabernacle] is said o have been made by the Florentine government, excepting the lid of the burial place of the della Stufa"), *regesto* Doc. 1423aa; 1427: Ser Giovanni Bonaiuti declares a Monte credit of 525 florins the interest on which is to be used perpetually "per uno cappellano perpetuale il quale a essere diputato a ufficiare uno altare il quale io o fatto fare nella chiesa di Sa Lorenzo alato <u>alla porta che va nella via della stufa"</u>. (Catasto 49, 453r), *regesto* Doc. 1427aa; 1444: Reference to "l'altare di sto Antonio <u>dalla porta alla stupha</u> tra due pilastri a pie di Sto Gregorio" (the altar of St Anthony at the porta della Stufa between two piers at the foot of St Gregory). (ACSL 1938 36r), *regesto* Doc. 1444a; 1445: February 13. Lotteringho d'Andrea della Stufa buried "<u>nel mezzo alla porta della Stufa"</u> (ACSL 1938 36v), *regesto* Doc. 1445a. See also: the decree issued on 16 March 1434 by the *signoria* ordering that a block of buildings adjacent to the basilica of San Lorenzo be demolished. According to Hyman: "the area to be levelled was specified in the decree; it ran from the palace of the della Stufa family on Via della Stufa, opposite the last portal of the old church ("*contra ultimam portam dicte ecclesie*"), to the shop of spice dealer Giusaffà in Via de' Ginori…," Hyman, "Notes and Speculations on S. Lorenzo," 107; and *regesto* Doc. 1434a.

[50] See basilica construction history, below.

[51] Moreni, *Continuazione*, vol. 1, 133 note 1; and *regesto* Doc. 1464a.

[52] Moreni, *Continuazione*, vol. 2, 358-360; and *regesto* Doc. 1423d.

[53] "pro porta sive ianua que dicitur la porta della via della stufa usque ad tabernaculum nostre donne quod dicitur factum per magnificam potentiam florentinam excepto chiusuro sepulture illorum della stufa." Catasto 49, 453r, 18 May 1423, document transcription and translation provided by Caroline Elam; see also *regesto* Doc. 1423aa; and Moreni, vol. 2, 119-120.

[54] "quod si quantum aliquo tempore contigeret quod cappelle crescerent et fierent per modum quod in dicto loco foret necesse fieri cappella ad similitudinem aliarum quae ibidem fierent pro ornamento et augmentatione dicte ecclesie." Catasto 49, 453r, 18 May 1423, document transcription and translation provided by Caroline Elam. See also *regesto* Doc. 1423aa. Cf. Moreni, vol. 2, 119-120.

[55] The old basilica proposal presented here is briefly summarized, in less-developed form, in: Cohen, "Ugly Little Angels Revisited," 90 note 27. Many scholars with whom I have since spoken resist my proposal that the old basilica stood off-center in relation to the present one.

[56] Saalman, "Filippo Brunelleschi: Capital Studies," 124.

[57] Saalman, "The New Sacristy of San Lorenzo Before Michelangelo," 202-203, 207.

[58] Saalman, *Filippo Brunelleschi: The Buildings*, 116 note 35.

[59] Saalman, *Ibid.*, 455.

[60] See notes 17-18.

[61] Borsi, Morolli and Quinterio, *Brunelleschiani*, Figs. 170, 201, 202, 289 and 292.

[62] Roselli and Superichi, *L'edificazione*, 133-136.

[63] Elam, however, cites Herzner, and Roselli and Superichi, as her sources, not Saalman. Elam, "Cosimo de' Medici and San Lorenzo," 161.

[64] Saalman, *Filippo Brunelleschi: The Buildings*, 110-111; Pietro Ruschi, "La cappella medicea o sagrestia nuova," in *San Lorenzo 393-1993*, 121, Ruschi, "San Lorenzo prima del Brunelleschi" in *Ibid.*, 39; and Morolli, "La 'Croce' di Giovanni, I 'più modi' di Filippo (1422-1428)," in *San Lorenzo 393-1993*, 50.

[65] Riccardo Pacciani, "Testimonianze per l'edificazione della Basilica di San Lorenzo a Firenze, 1421—1442" *Prospettiva* 75-76 (July-Oct. 1994), 85; Arnaldo Bruschi, *Filippo Brunelleschi* (Milan: Electa, 2006), 108; and Pietro Ruschi, "La Sagrestia Nuova, metamorfosi di uno spazio," in *Michelangelo architetto a San Lorenzo: quattro problemi aperti*, Pietro Ruschi, ed. (Florence, 2007), 23, 26.

[66] Morolli, "Non solo Brunelleschi: San Lorenzo nel Quattrocento," in Timothy Verdon, ed., *Alla riscoperta delle chiese di Firenze: 5. San Lorenzo* (Florence, 2007), 58, 61, 73; and Morolli, "La 'Croce' di Giovanni, I 'più modi' di Filippo (1422-1428)," in *San Lorenzo 393-1993*, 50.

[67] Sanpaolesi was the first to make note of the facade seams and to associate them with the old basilica. However, in an argument that is not clear, he interprets them as evidence that the present basilica was constructed from east to west, around and eventually replacing the old basilica. Piero Sanpaolesi, *Brunelleschi* (Milan: Edizioni per il Club del Libro, 1962), 73-74; and notes 17-18.

[68] Saalman has never presented evidence that the wall fragment in question is indeed a remnant of the old campanile foundation. He simply describes it as such, as in his statement: "a wall fragment of the campanile was left standing under the portal-chapel." Saalman, "The New Sacristy Before Michelangelo," 207. He later provides a photograph of the wall fragment with the caption: "Foundations of old campanile in underchurch under the seventh northern side chapel." Saalman, *Brunelleschi: The Buildings*, 191, 194-195.

[69] Saalman, *Filippo Brunelleschi: The Buildings*, 439; and *regesto* Doc. 1481a.

[70] On 30 July 1448 a mason was paid for construction work that included the "door of the campanile" (*porta dal campanile*). If the campanile had stood in the seventh aisle bay in question, however, the door would have been inaccessible. Hyman, "Fifteenth Century Florentine Studies," 497; *regesto* Doc. 1448f; and note 40, above.

[71] Dr. Rowland Mainstone, letter to Matthew A. Cohen, 7 September 2010.

[72] Giuliano De Marinis, "San Lorenzo – I dati archeologici" in *San Lorenzo: 393-1993*, 33.

[73] Architect Giuseppe Ruggieri notes in his report of 1741-2 that portions of failed foundations in the basilica had been constructed with gravel from the Mugnone, a river that once passed through the site of the basilica. Roselli and Superichi, *L'edificazione*, 55. This former river, long since diverted, could have created ground water issues for the old and new basilicas.

[74] Mainstone, letter to Matthew A. Cohen, 13 October 2010.

[75] The only possible remaining evidence that the campanile might have been located on the site of the present northern side door is a document, which no scholar has ever cited in this context, is found in a notarial record of 23 May 1433. The document indicates, according to Elam, that: "The prior had already in September 1423 been given authority to allocate … [the chapel of Luca di Marco], described as 'next to the campanile of the said church and next to the chapel to be made by the heirs of Zanobi di ser Gino.'" Elam, "Cosimo de' Medici and San Lorenzo," 167; and *regesto* Interpolated Doc. 1423e and Doc. 1433a. The chapel of Luca di Marco is the corner chapel today located next to the northern side door (Figure 2-1). Therefore, if this chapel were to have been located next to the old

campanile, the old campanile would have to have been located on the site of the present northern side door. Elam has recently informed me, however (in an e-mail of 28 April 2010), that since the publication of the preceding transcription in 1992 she has changed the transcription of "nolarium," which she had translated as "campanile" above, to "navarium," which could mean "nave." Elam notes that the original document should be checked again. Barring any new evidence to support the previous reading, this document should not be interpreted as evidence that the chapel of Luca di Marco once stood next to the old campanile.

[76] Cohen "How Much Brunelleschi?," 43.

[77] *Ibid*., 42.

[78] *Ibid*., 43.

[79] See, for example, the comments of Andrew Leach: "[Cohen] concludes that responsibility for part of the design of San Lorenzo lies with Brunelleschi's predecessor, Prior Matteo di Bartolommeo Dolfini. Cohen's analysis suggests that, as much as San Lorenzo might be understood as a building heralding new beginnings, it ought also to be understood in terms of the fourteenth-century compositional and construction practices that endured into the fifteenth century, and therefore in terms of a medieval tradition that casts a long shadow over the Renaissance," *What is Architectural History?* (Cambridge: Polity Press, 2010), 86; Robert Bork: "…as Matthew Cohen has recently argued, the proportions of San Lorenzo may well have been largely established before Brunelleschi's intervention," *The Geometry of Creation: Architectural Drawing and the Dynamics of Gothic Design* (London: Ashgate Press, 2011), 421 and 427; and Marvin Trachtenberg's reference to: "...Brunelleschi's transformation of Prior Dolfini's project [at S. Lorenzo] following the new reading of Matthew Cohen…, *Building-in-Time: From Giotto to Alberti and Modern Oblivion* (New Haven and Yale: Yale University Press, 2010), 443 n. 144.

[80] Volker Herzner, "'How much Brunelleschi?' Matthew Cohen und sein Phantom-Architekt von San Lorenzo in Florenz," *Kunstgeschichte* 2010-11. < http://www.kunstgeschichte-ejournal.net/archiv/2010/herzner/> (Accessed 12 October 2010). Others have questioned the extent of my Dolfini attribution in conversations with me.

[81] See, for example, Janson: "What makes the interior of San Lorenzo seem so beautifully integrated? There is indeed a controlling principle that accounts for the harmonious, balanced character of his design: the secret of good architecture, Brunelleschi was convinced, lay in giving the 'right' proportions—that is, proportional ratios expressed in simple whole numbers—to all the significant measurements of a building." H. W. Janson, *History of Art*, 3rd ed. (New York, 1986), 410; 6th ed. (2001), 398; and with slight modification by a team of authors, 7th ed. (2007), 511; and 8th ed.

(2011) 512-514. See also Peter Murray: "[Brunelleschi's] Florentine churches became examples of proportional planning, since they took an established building type and subjected it to a mathematical discipline….the total effect is…much more harmonious than was the case in a church like Sta Croce." Peter Murray, *The Architecture of the Italian Renaissance* (New York: Schoken Books, 1963), 33-34.
[82]Rudolf Wittkower, "Brunelleschi and 'Proportion in Perspective,'" *Journal of the Warburg and Courtauld Institutes* 16 (1953), 275-291. I can report anecdotally, from my numerous recent conversations with scholars, that the views expressed in Wittkower's article cited here remain prevalent today.
[83] With this statement I articulate a position opposite to that of Wittkower, who states: "I think it is not going too far to regard commensurability of measure as the nodal point of Renaissance aesthetics." Rudolf Wittkower, *Architectural Principles in the Age of Humanism* (New York and London: W.W. Norton & Company, 1971), Appendix II, 158.
[84] *Ibid*., and Wittkower, "Brunelleschi and 'Proportion in Perspective,'" 275-291.
[85] Cohen, "The Lombard Connection," 33-39. Another observation of similar sets of proportions in buildings of dissimilar styles may be made in the early Renaissance-style basilica of San Lorenzo and the Gothic style Basilica of Santa Maria del Fiore in Florence. In both, key width-by-height proportions of the nave arcade bays are determined by root-2 rectangles measured plinth to plinth, and dimensioned with pairs of numbers that closely approximate the ratio 1:√2. Cohen, "Quantification and the Medieval Mind," 1-30.
[86] For the belief that Dolfini's foundations were to blame for structural weaknesses in the crossing area, see the citation of Migliore's seventeenth century *Firenze illustrata* in architect Giuseppe Ruggieri's 1741 report. Roselli and Superichi, *L'edificazione*, 55; and Saalman, *Filippo Brunelleschi: The Buildings*, 179. See also Eugenio Battisti, *Brunelleschi: The Complete Work* (New York: Rizzoli, 1981), 179; Hans Folnesics, *Brunelleschi: Ein beitrag zur entwicklungsgeschichte der fruhrenaissance-architektur* (Vienna: Kunstverlag Anton Schroll & Co., 1915), 32; and Cornel von Fabriczy, *Filippo Brunelleschi: Sein Leben und seine Werke* (Stuttgart: J. G. Cotta, 1892), 154-169. Morolli, "Non solo Brunelleschi," 62; and Borsi, Morolli and Quinterio, *Brunelleschiani*, 79, 266 and 291.
[87] "… murandosi la chiesa di San Lorenzo di Firenze, principiato pe' popolani di quella e fattone capomaestro el priore della chiesa che v'era in que' tempi, che era oppenione ch'egli intendessi secondo gli altri architettori di que' tempi, e avevala cominciata di pilastri di mattoni …" Manetti, *Vita*, ed. Tanturli, 106. Note in this passage Manetti's indication that the basilica was begun by the parishioners, and therefore was, as Caroline Elam has emphasized in conversation with me, "a

corporate enterprise." For a similar assessment see Anthony Molho, "Cosimo de' Medici: Pater Patriae or Padrino?", *Stanford Italian Review* 1 (1979), 27-28.

[88] "e' fece conclusione che la fabrica vecchia s'abandonassi e disfacessesi e atendessisi al tutto a uno de' modi di Filippo." *Ibid*., 107. By this point in Manetti's narrative, the "corporate enterprise" (see preceding note.) had apparently been taken over by Giovanni de' Medici.

[89] See note 86, above, and: Migliore as quoted in: Roselli and Superichi, *L'edificazione*, 55; Luigi Zumkeller, "L'isolamento della Basilica di San Lorenzo e la questione della parete tergale della chiesa," *Firenze: Rassegna del Comune* (October, 1938), 377-381; and Peter J. Gärtner, *Filippo Brunelleschi: 1377-1446* (Cologne: Könemann, 1998), 36-40. Since a payment to Giuliano di Nanni, *scarpellatore*, for 90 br of corner pilaster strips to be placed in the high altar chapel was recorded on 22 December 1442, and other payments of that time indicate that construction of the foundations for the nearby freestanding crossing piers was only just getting underway, Hyman surmises that portions of the high altar chapel walls completed prior to a construction hiatus that began in 1425 may have been incorporated into the new work. Hyman, "Fifteenth Century Florentine Studies," 320, 326, 435 and 439.

[90] Battisti, *Filippo Brunelleschi*, 179.

[91] Saalman, *Filippo Brunelleschi: The Buildings*, 112-13.

[92] Ginori Conti, *La Basilica di S. Lorenzo*, 52-54; Paatz, *Die Kirchen von Florenz*, 465; Sanpaolesi, *Brunelleschi*, 71-77; Herzner, "Zur Baugeschichte von San Lorenzo," 106-108; Idem, "Letter to the Editor," 634; Idem, "'How much Brunelleschi?' Matthew Cohen und sein Phantom-Architekt"; and Bruschi, *Filippo Brunelleschi*, 108-109. Elam doubts the long-term influence of Dolfini's plan, noting: "… if the main part of the work began in 1421-2, and Prior Dolfin [sic] was dead by 1420, the status of his plan seems rather uncertain." Elam here seems to base her doubts, however, on Cianfogni's claim that Dolfini died in 1420, a claim that is contradicted by a document of 22 February 1422 (modern style) that Elam had previously published, which indicates that Prior Matteo Dolfini was absent (*absente*), and thus either still alive or only very recently deceased. Elam, "Cosimo de' Medici and San Lorenzo," 163-164; Cianfogni, *Memorie istoriche*, 190; Elam, "The Site and Early Building History," Doc. A, p. 184, and *regesto* Doc. 1422a.

[93] If Brunelleschi had wanted to maintain Dolfini's site boundaries and floor plan but change Dolfini's set of proportions, his only recourse would have been to alter the points of measurement at which the set of proportions meets the building fabric—for example, moving from a plinth to plinth system to an on center system—and such minor adjustments would have been large enough to have destroyed Dolfini's set of proportions, but probably not large enough to have allowed Brunelleschi

enough flexibility to create a new one. On the virtually inevitable derivation of the nave arcade bay sets of proportion from the overall basilica sets of proportion, see Chapter 3.

[94] Bruschi, *Brunelleschi*, 85; Burns, "Quattrocento Architecture and the Antique," 279; and Heinrich Klotz, *Filippo Brunelleschi: The Early Works and the Medieval Tradition* (London: Acaddemy Editions, 1990), 133-139.

[95] Burns, *Ibid*., Howard Saalman, "Carrara Burials in the Baptistery of Padua," *Art Bulletin* 69 (1987), 376-394; and Marvin Trachtenberg, "Brunelleschi, 'Giotto' and Rome" in *Renaissance Studies in Honor of Craig Hugh Smyth*, ed. A. Morrogh et. al. (Florence: Giunti Barbéra, 1985), 675-697.

[96] Note that with this scenario I propose a limited cooperation between Dolfini and Brunelleschi, under Dolfini's supervision. Also note that having his design responsibility limited to the architectural articulations in no way diminishes Brunelleschi's accomplishments, since these articulations, more than the overall spatial conception, are responsible for the profound influence of this building on the history of architecture beginning even before its completion. Cohen, "How Much Brunelleschi?," 43, note 102.

[97] According to my survey, the main room of the Baptistery of Padua measures 1101.5 cm (18.87 Florentine *braccia*) long by 1137.2 cm (19.49 Florentine *braccia*) wide, plinth to plinth. The full length of the baptistery, from the plinths of the back wall of the main room, to the back wall of the altar chapel, which has no pilaster plinths, measures 1564.1 cm (26.80 Florentine *braccia*). The above parenthetical equivalents in Florentine *braccia* indicate how the dimensions of this structure, which was presumably designed and built in Paduan *piedi*, might have been interpreted in terms of Florentine *braccia* by a late medieval Florentine architect measuring it with the intention of adapting the design to a new structure to be built in Florence.

[98] Dolfini or Brunelleschi merely needed to round off the dimensions of the Paduan baptistery, measured in Florentine *braccia*, to the nearest whole numbers to arrive at the overall Old Sacristy dimensions of 19 br x 19 br, and 19 br x 27 br. See also the preceding note.

[99] Cohen, "How Much Brunelleschi?," Appendices 4 and 7.

[100] The interior height of the Old Sacristy main room, measured with a Leica Disto measuring device from the floor to the underside of the fascia ring that frames the oculus, at four points around the ring, varies from 1921.65 cm to 1923.3 cm. An exact distance of 33 br would measure 1925.88 cm (because 33 x 58.36 = 1925.88).

[101] Note that no harmonic interpretation of this simple ratio is warranted by documentary evidence.

[102] One can, of course, continue to analyze the proportions of the sacristy by examining, for example, the pilaster height proportions in terms of various possible modules such as the pilaster shaft widths

measured at the base and middle of each shaft. According to my analysis, however, none of these modular relationships appear to be intentional, or historically significant in any way.

[103] Similar to the scenario under consideration, in 1404 Brunelleschi sat on a board of nineteen advisors to the *Opera* of Santa Maria del Fiore that determined that a buttress completed by Giovanni d'Ambrogio should be partially demolished and reconstructed because it was "at variance with the required and true measures." The new work was presumably rebuilt upon the existing foundations. Frank D. Prager and Gustina Scaglia, *Brunelleschi: Studies of His Technology and Inventions* (Cambridge, Massachusetts: MIT Press, 1970), 16.

[104] "Cum hoc sit, ut infrasciptus dominus prior asseruit, quod de anno 1419, vel circa, tempore recolende memorie domini Mattei Dolfini, tunc prioris ecclesie, et celeberrimi templi S. Laurentii predicti, et infrascripti domini Benedicti nunc prioris, et tunc canonici dicte ecclesie et templi fuisset incepta fundari cappella major ecclesie…." Ginori Conti, *La Basilica di S. Lorenzo*, 236-237; and *regesto* Doc. 1440c. As argued below, however, the more likely start date for construction is 1421.

[105] Manetti, *Vita*, ed. Tanturli, 108; Elam, "Cosimo de' Medici and San Lorenzo," 160, 164; Volker Herzner, "'How much Brunelleschi?' Matthew Cohen und sein Phantom-Architekt von San Lorenzo in Florenz," *Kunstgeschichte*, Texte zur Diskussion, 2009-26, <http://www.kunstgeschichte-ejournal.net/archiv/2010/herzner/, accessed 17 April 2011>; and Idem, "Ein Phantom ist ein Phantom ist ein Phantom - Antwort auf Jens Niebaums Versuch, in der Diskussion um die Baugeschichte von San Lorenzo die Position Matthew Cohens hinsichtlich des Phantoms Dolfini als Architekten zu untermauern," Kunstgeschichte, Texte zur Diskussion 2009-44, 2009-47 <http://www.kunstgeschichte-ejournal.net/kommentare/2009/herzner/, accessed 17 April 2011>>.

[106] Cf. Trachtenberg's argument that in the design and construction of the cupola of Santa Maria del Fiore, "…alongside Brunelleschi, Ghiberti as well as Battista d'Antonio served as capomaestri." Marvin Trachtenberg, Review of Howard Saalman, *Filippo Brunelleschi: The Cupola of Santa Maria del Fiore*, in *Journal of the Society of Architectural Historians* 42 (1983), 295-296.

[107] Note that in Figure 4-13, I include in the transept width dimension the exterior wall thicknesses to arrive at a length of very nearly 110 br, as specified in the 1418 petition. Previously, however, in the length dimension I have proposed that the exterior wall thickness of the high altar chapel should probably be *excluded* to arrive at the 65 br dimension that both Dolfini and Brunelleschi intended (Figure 4-5, measurement from the back of the high altar chapel to Line A2). In the latter case, however, I have provided measurements both including *and* excluding the wall thickness, for the reader's inspection (Figure 4-5, Lines A1 and A2). In making these judgments pertaining to the 110 br and 65 br dimensions specified in the 1418 petition, I am following the evidence provided by the

measurements. I thus assume, in the absence of evidence to the contrary, that the original architects and builders occasionally shifted points of measurement to include or exclude wall thicknesses according to construction exigencies.

[108] A document of 28 February 1422 (modern style) notes that the prior of the church, Matteo Dolfini, was absent (*absente M. domino Matteo Dolfini tunc priore dicte ecclesie*). See note 92, above; Elam, "The Site and Early Building History," Doc. A, p. 184; and *regesto* Doc. 1422a. Another document of 3 April 1422 notes that Bartolomeo da Vinci was prior. Elam, "Cosimo de' Medici and San Lorenzo," 161, n. 17 and 18; and *regesto* Doc. 1422d. For the record of the groundbreaking ceremony on the feast day of St. Lawrence, 10 August 1421, see Riccardo Pacciani, "Testimonianze per l'edificazione della Basilica di San Lorenzo a Firenze, 1421-1442," *Prospettiva* 75-76 (July-Oct. 1994), 94, Doc. 1; and *regesto* Doc. 1421a. Construction activity on the site of the new basilica is documented just eight days later, on 18 August 1422, though additional undocumented construction work could have taken place earlier. Pacciani, *ibid*., 94, Doc. 2. A document of 1440 states that construction began "in the year 1419, or thereabouts." Ginori Conti, *La basilica di San Lorenzo*, 236–240; and *regesto* Doc. 1440c. Another document of 1442 notes that it had been "twenty-three years, or thereabouts," since construction of the new church of San Lorenzo had begun. Ginori Conti, *La basilica di San Lorenzo*, 240–245; and *regesto* Doc. 1442e), thus again pointing to the year 1419. No known San Lorenzo construction documents, however, date from before 1421, and the 1419 date appears to be unreliable. The authors of the 1440 document appear to have been unaware of the 1421 groundbreaking ceremony, and perhaps derived the 1419 estimated start date by adding a few months of assumed preparation time to the date of the petition of 22 December 1418. The authors of the 1442 document perhaps simply repeated the 1419 date from the 1440 document.

[109] "…si disfecie per fare la chiesa nuova cioè le chappelle." Pacciani, "Testimonianze per l'edificazione," 95, Docs. 6 and 7; and *regesto* Doc. 1422e.

[110] "…per fare la sagrestia…." Pacciani, *ibid*., 95, Doc. 14; and *regesto* Doc. 1422f.

[111] "…che fanno i fondamenti di chosimo…." Saalman, *Brunelleschi: The Buildings*, 112 note 20; and *regesto* Doc. 1422g. This document indicates that Cosimo must have been managing the project for his father.

[112] The document notes that masons stored their tools in a nearby house during excavation of the foundations of the church ("quando chavono i fondamenti"). Pacciani, "Testimonianze per l'edificazione," 94, Doc. 2; and *regesto* Doc. 1421b.

[113] On 1 October 1422 a house on Via de' Preti was demolished to make way for the Old Sacristy ("per fare la sagrestia"). Pacciani, "Testimonianze per l'edificazione," 95, Doc. 14; and *regesto* Doc.

1422f. On 21 October 1422 workers were paid for "making Cosimo's foundations" ("i fondamenti di chosimo"). See note 111, above. Saalman, *Brunelleschi: The Buildings*, 112, note 20; and *regesto* Doc. 1422g. In a declaration dated 1447, Ugolino di Niccolò Martelli and his brothers refer to a provision in their father's will of June 1423 for the construction of a chapel "together with others." The chapel has been known as the *Cappella degli Operai* since at least 1427. G. Pudelko, "Per la datazione delle opere di Fra Filippo Lippi," *Rivista d'arte* 18 (1936), 60 note 2; Elam, "Cosimo de' Medici and San Lorenzo," 166 note 42, and 167 note 44; and *regesto* Docs. 1423c, 1427c, and 1447a. On 21 July 1423 the church granted the Rondinelli family permission to demolish its family chapel in the old basilica of San Lorenzo and to build a new one in a corresponding position in the new church. Moreni, *Continuazione*, vol. 2, 358–360; and *regesto* Doc. 1423d. The other transept chapels were allocated to their patrons between 1423 and 1433. On 24 November 1442 the Medici construction ledger records payments for excavation of the foundation holes for the two freestanding crossing piers. thus initiating construction of the nave. Hyman, "Fifteenth Century Florentine Studies," 437; and *regesto* Doc. 1442j.

[114] The other parts of the basilica originally intended to be built and paid for by the prior and canons include, presumably, the crossing square, nave, clerestory, roof and facade. Patronage of these parts and the high altar chapel were later transferred to Cosimo de' Medici. As *capomaestro*, however, Dolfini would have been responsible for overseeing all construction work on the basilica, including the private chapels.

[115] See above and Manetti, *Vita*, ed. Tanturli, 106.

[116] Measured plinth to plinth, the back (west) wall of the high altar chapel is 1113.7 cm (19.08 br) wide, the north wall is 1085.1 cm (18.59 br) long, and the south wall is 1084.2 cm (18.58 br) long. Measurements were recorded by the author with a steel tape measure manufactured by SEB in June 1992, and verified in June 2009. Note that according to my method, rounding off these dimensions in order to interpret the high altar chapel as measuring 19 br square involves an extensive process of critical examination and analysis of the measurements and other evidence, all of which is made available for the reader's evaluation. See Chapter 3. On the post-fifteenth century alterations at these locations, see notes 21-22 above.

[117] Some pre-fourteenth-century medieval basilicas in Florence, such as those of Santa Croce and Santa Maria Novella, do not display square high altar chapels with crossing squares of corresponding dimensions in front of them. By the late fourteenth and early fifteenth centuries, however, such an arrangment had become predominant. The fourth iteration shown in Figure 3-10 is an elaboration of

basic modular subdivision observed in the San Lorenzo floor plan set of proportions. See Cohen, "The Lombard Connection," 33-39; and Chapter 3.

[118] For a more detailed analysis of the overall basilica set of proportions that takes into consideration the crossing pier thicknesses and other contingencies, see Chapter 3.

[119] Note that in Figure 4-16, the near alignment of Line G with the internal wall of the hypothetically-reconstructed old cloister is coincidental. The same is true of the near alignment of the southern nave wall of Dolfini's reconstructed basilica plan with the same internal wall seen in Figure 4-15.

[120] See Chapter 3.

[121] In light of the diagrams shown in Figures 3-7 to 3-10, no other number of nave bays would be geometrically logical. On the derivation of these floor plan diagrams and their relationships to late fourteenth and early fifteenth-century church architecture, see Cohen, "How Much Brunelleschi," Appendix 7; and Idem, "The Lombard Connection," 31-44. Conceptual modularity occurs when a modular pattern is evident even though some dimensional approximations must be accomodated. Dimensional modularity occurs when such patterns correspond to the building measurements with great precision. See also Cohen, "How Much Brunelleschi,?" 37.

[122] "…che gli pareva avere posto una chiesa secondo la sua intenzione in quanto al composto dello edificio." Manetti, *Vita*, ed. Tanturli, 123-124.

[123] See Chapters 2 and 3.

[124] Cohen, "Quantification and the Medieval Mind," 1-30. In the Basilica of Santa Trinita, the lower order of piers in the nave arcades have proportions similar to those of San Lorenzo (Figure 4-12, left). However, bay-by-bay dimensional variations in Santa Trinita are too large to allow definitive analysis of the designer's proportional intentions.

[125] My surveys of the basilicas of Santa Maria del Carmine in Pavia and Santa Trinita in Florence, for example, when all measurements are expressed in fifteenth-century Florentine *braccia*, indicate plinth widths of approximately 2 *braccia*.

[126] Cohen, "How Much Brunelleschi?," 42.

[127] Questions about the degree of Brunelleschi's authorship of the basilica of San Lorenzo notwithstanding, the basilica deserves to be included in the Brunelleschi *oeuvre* because, as I have argued in the first paragraph of this chapter, the basilica "…owes its present appearance primarily to Filippo Brunelleschi."

[128] Cianfogni, *Memorie istoriche*, 183. In April, 1384 the Bishop of Florence, Angelo Acciaiuoli II, announced that an indulgence would be granted to all those who make a contribution toward the "enlargement and improvement" ("ampliare et in melius reformare") of the church of San Lorenzo.

Cianfogni, *Memorie istoriche*, 175; Ruschi, "San Lorenzo prima del Brunelleschi," 38; and *regesto* Doc. 1384a.

[129] Antonio del Bene was a member of a prominent Florentine family, was not a canon of the church, and was loyal to Rome. Cianfogni, *Memorie istoriche*, 177–178; and *regesto* Doc. 1391a.

[130] Like del Bene, Matteo di Cola da Rieti was selected from outside the ranks of the church canons. *Ibid*., 181, 226–228 and 231; and *regesto* Docs. 1404a and 1417b.

[131] Note, however, that the term "le scienze," which I quote here from Cianfogni's account, may not be a direct quotation from the document Cianfogni cited. Cianfogni, *Memorie istoriche*, 186–188; and *regesto* Doc. 1417c.

[132] Because 1417-1391 = 26. Alternatively, Dolfini had thirty-four years to plan the transformation of the church between the time he became a canon of the church in 1383 and his election in 1417. For more biographical information on Dolfini, see below.

[133] "…nel murare la pratica insegnia quello che sa a seghuire." Manetti, *Vita*, ed. Tanturli, 88.

[134] Cohen, "The Lombard Connection," 38-39.

[135] See note 31, above.

[136] The nave and transept cross sections contain closely approximated root-2 rectangles expressed very nearly with the whole-number dimensions 19 br x 27 br, just like the floor plan proportions of the Old Sacristy, measured plinth to plinth. For a detailed analysis see Cohen, "How Much Brunelleschi?," 40-41.

[137] William M.Bowsky, *La chiesa di San Lorenzo a Firenze nel medioevo*, ed. Renzo Nelli (Florence: Edizioni della Meridiana, 1999), 167 note 16. Another reference to the old cloister is provided by the chronicler Vespasiano da Bisticci, who notes that Cosimo demolished it: "Cosimo la prima cosa cominciò a gittare tutta l'abitatione de' preti per terra…." Vespasiano da Bisticci, *Le vite*, ed. Aulo Greco, vol. II (Florence: Istituto Nazionale di Studi sul Rinascimento, 1976), 181.

[138] Both Cianfogni and Saalman note that the old cloister stood to the south of the old basilica, without citing any supportive evidence or reasoning for this assertion. Cianfogni, *Memorie istoriche*, 78 note 1; and Howard Saalman, Letter to the Editor, *Journal of the Society of Architectural Historians* 50 (1991), 343.

[139] Saalman notes that "the entire group of views…" deserves further study, but only acknowledges the existence of two views, in addition to the Rustici view. *Ibid.*, 343 and 343 note 2.

[140] Olive, "The Codex Rustici," 593-594.

[141] The note reads in part: "…Petri del massaio Florentini qui me picturis decoravit. Anno domini millesimo quadrigentesimo sexagesimo nono Florentie." Giuseppe Boffito and Attilio Mori, *Piante e*

vedute di Firenze: studio storico topografico cartografico (Rome: Giuntina, 1926; rpt. Rome: Multigrafica Editrice, 1976), 8, 11; Lilian Armstrong, "Benedetto Bordon, 'Miniator,' and Cartography in Early Sixteenth-Century Venice," *Imago Mundi* 48, 1996, 74, 87 note 54; and J.M. Rogers, "Itineriaries and Town Views in Ottoman Histories" in *The History of Cartography; Volume 2, Book 1: Cartography in the Traditional Islamic and South Asian Societies*, eds. J.B. Harley and David Woodward(Chicago: The University of Chicago Press, 1992), 238.

[142] Saalman, Letter to the Editor, 343. On 15 May 1457 the church canons held a dinner to celebrate the "beginning of the construction of the new cloister" (*per dare opera, e principio a edificare el Chiostro nuovo*). Moreni, *Continuazione*, vol. 1, 14; and *regesto* Doc. 1457d. On 12 August 1461 apartments in the cloister were assigned to fourteen resident canons of the church. Roselli and Superchi, *L'edificazione*, 128; also quoted in Moreni, *Continuazione*, vol. 1, 14 note 3; and *regesto* Doc. 1461d.

[143] The high altar of the new basilica was consecrated on 9 August 1461. James Beck, "Desiderio da Settignano (and Antonio del Pollaiuolo): Problems," *Mitteilungen des Kunsthistorischen Instituts in Florenz* 28 (1984), 215 note 3; and *regesto* Doc. 1461c. A document of 9 October 1464, to be discussed in detail below, indicates that the old basilica was still standing. Moreni, *Continuazione*, vol. 1, 133 note 1; and *regesto* Doc. 1464a. Between the new high altar and the old basilica, the transept and first three bays of the nave of the new basilica had also been completed by 1461. On 29 July 1446 "6 large columns of macigno" (*6 colonne grandi di macigno*) were ordered, and on 11 October 1448 all six had been delivered to the site. Hyman, "Fifteenth Century Florentine Studies," 538-540; and *regesto* Docs. 1446e and 1448k. On 2 May 1456, a dinner was held for workers who were about to close the crossing dome. Saalman, *Filippo Brunelleschi: The Buildings*, 439, Doc. 9; and *regesto* Doc. 1456a.

[144] Mary Bergstein, "Marian Politics in Quattrocento Florence: The Renewed Dedication of Santa Maria del Fiore in 1412," *Renaissance Quarterly* 44 (1991), 675. The use of the old name by Pietro del Massaio fifty-seven years after the decree abolishing its use would seem to have three possible explanations: either the decree was roundly ignored in Florence, Pietro del Massaio used the old name to indicate that the information in Cod. Vat. Lat. 5699 represented Florence from before 1412, or he used the old name for nostalgic effect.

[145] Boffito and Mori, *Piante e vedute*, Fig. 4; Hyman, "Fifteenth Century Florentine Studies," 95, 126, 133-135; Dale Kent, *Cosimo de' Medici and the Florentine Renaissance: The Patron's Oeuvre* (Yale University Press: New Haven and London, 2000), 218, 234. On Pierfrancesco's house see also: Alison Brown, "Pierfrancesco de' Medici, 1430-1476: A Radical Alternative to Elder Medicean

Supremacy?," *Journal of the Warburg and Courtauld Institutes* 42 (1979), 84-85; and Hyman, "Fifteenth Century Florentine Studies," 70-79.

[146] Boffito and Mori, *Piante e vedute*, 12. As quoted by Scaglia, de Rossi concurs, attributing all of the so-called Ptolomaic plans by Pietro del Massaio, based on corruptions in the Latin nomenclature, to a "… prototype 'certainly some time before the diffusion of humanist learning,' perhaps as early as 1422." G.B. De Rossi, Piante iconographiche e prospettiche di Roma anteriori al secolo XVI, 1879, 91, as quoted in Gustina Scaglia, "The Origin of an Archaeological Plan of Rome by Alessandro Strozzi," *Journal of the Warburg and Courtauld Institutes* 27 (1964), 138.

[147] Scaglia concurs, noting: "Despite the fact that Piero [sic] del Massaio is credited with the illustrations in all three Ptolomeic manuscripts [i.e., Cod. Vat. Lat. 5699, Cod. Vat. Urb. 277, and MS Lat. 4802], he did no more than copy the maps and city-plans from earlier and various sources. *Ibid*., 138 note 4.

[148] See note 108, above, and *regesto* Doc. 1421a.

[149] This view was made as part of a copy of Ptolemy's *Cosmographia* that was produced in the shop of Vespasiano da Bisticci for Federigo da Montefeltro, Count of Urbino. Armstrong, "Benedetto Bordon, 'Miniator,' and Cartography, 73-74, 87 note 54; and Boffito and Mori, *Piante e vedute di Firenze*, 9-10.

[150] Like Cod. Vat. Lat. 277, this view, MS Lat. 4802, was written by the scribe Hugo de Comminelli of Mezières, but was made for Alfonso, Duke of Calabria. Armstrong, "Benedetto Bordon, 'Miniator,' and Cartography," 73-74, 87 note 54.

[151] Mediateca di Palazzo Medici Riccardi: Window on the Renaissance, "Anonimo--*Storia fiorentina dall'origine della città fino all'anno 1455*, di Poggio Bracciolini, c. 1v: Florentia (Detail)," <http://www.palazzo-medici.it/mediateca/en/immagine.php?id=188> (23 April 2011). I thank Jack Wasserman for calling this source to my attention.

[152] On the Ambrosian origins of the church, see Cianfogni, *Memorie istoriche*, 1-30 and 34. For evidence that the first church of San Lorenzo served as the city's first cathedral, see *ibid*., 42-49 and 54-56; Paatz, Die Kirchen von Florenz, vol. 2, 465; Ginori Conti, *La Basilica di S. Lorenzo*, 6-8; and Saalman, *Filippo Brunelleschi: The Buildings*, 108-109. For a contrary opinion regarding the Basilica of San Lorenzo as the city's first cathedral, see Emilio Grosso, "Santa Giuliana, fondatrice dell'Ambrosiana Basilica di S. Lorenzo in Firenze," in *La Graticola* 4 (1977), 23-24. On Santa Giuliana, purported founder of the church, see *ibid*., 7-22 and Cianfogni, *Memorie istoriche*, 2-12.

[153] For historical references to the old cloister, see notes 136 and 137, above. The approximate dimensions of the hypothetical reconstruction of the old cloister of San Lorenzo shown in Figure 4-15 are based in part on those of the early fifteenth-century Orange Cloister of the Badia of Florence.

[154] The sacristy of the old basilica was built between 1300 and 1302, and was large enough to accommodate meetings of the entire chapter of San Lorenzo. Ruschi suggests that this sacristy may be the gabled structure shown behind the campanile in the del Massaio view in MS Lat. 4802 (Figure 4-19), a structure that I have alternatively suggested may be the north transept arm of the present basilica. Ruschi proposes a *trecento* origin for the old campanile based on stylistic evidence provided by the Codex Rustici view. Ruschi, "San Lorenzo prima del Brunelleschi," 37-38.

[155] Elam documents seventeen private chapels or chaplaincies in the old basilica in 1422, which were founded as early as 1295. Elam, "Cosimo de' Medici and San Lorenzo," 161-162, 176-177.

[156] "…operi et constructioni ecclesie Sancti Laurentij de Florentia…." Ruschi, "San Lorenzo prima del Brunelleschi," 38; and *regesto* Doc. 1374a.

[157] Ruschi, "San Lorenzo prima del Brunelleschi," 38; Cianfogni, *Memorie istoriche*, 175, 183; and *regesto* Docs. 1384a, 1417a. The church of San Martino in Quona is mentioned in the documentary record as early as 1274. It received a new façade portal and perhaps other alterations in 1585, and further additions and alterations in the eighteenth century. "Popolo di S. Martino a Quona: La chiesa di S. Martino," <http://www.tuscany.name/CORNUCOPIA/popoli/pont/psmquona.htm> (23 April 2011).

[158] "…gens conditionis depresse, fame non commendabilis...& ut plurimum aliene Nationis...." Ginori Conti, *La Basilica di S. Lorenzo di Firenze*, 234–236; and *regesto* Doc. 1418a.

[159] The reconstructed site plans shown in Figures 4-14, 4-15, 4-16, 4-22, 4-23, 4-24, 4-27, 4-28, 4-31 and 4-32 include variously collaged and redrawn fragments of the 1768 Prague floor plan of the San Lorenzo cloister, modern municipal maps of Florence, and new drawings by the author. Materials have been drawn from: Pietro Ruschi, "La canonica e i chiostri," in *San Lorenzo 393-1993*, 72; and *Atlante di Firenze* (Florence, Marsilio, 1993), 63-64.

[160] See note 87, above.

[161] Manetti, *Vita*, ed. Tanturli, 77-81.

[162] A document of 28 February 1422 (modern style) notes that prior Dolfini was "absent," thus suggesting that he was either still alive or only recently deceased. Elam, "The Site and Early Building History," 184, Document A; and *regesto* Doc. 1422a. Cianfogni's assertion that Dolfini died in 1420 is probably in error, as is almost certainly his claim that Benedetto Schiattesi succeeded Dolfini as prior. Cianfogni, *Memorie istoriche*, 190. By 3 April 1422, Bartolomeo da Vinci was prior. Elam,

"Cosimo de' Medici and San Lorenzo," 161 notes 17 and 18; and *regesto* Doc. 1422d. By 12 November 1422, Benedetto di Matteo Schiattesi was prior. Elam, *ibid*., 161 note 18; and Moreni, *Continuazione*, vol. 2, 355 (Elam, citing Moreni, notes the date as 11 November 1422; however, Moreni notes it as 12 November 1422). On Giovanni's ascendancy, see Manetti, *Vita*, ed. Tanturli, 106-107. On the basilica reconstruction project as a "corporate enterprise," according to Elam, before Giovanni exerted control see notes 87 and 88, above.

[163] Manetti, *Vita*, ed. Tanturli, 107.

[164] See note 31, above.

[165] On the high altar chapel wall height of "about eight braccia" ("b[raccia] otto o circa") see: "Regesto dei documenti," in *Donatello e la Sagrestia Vecchia*, 103, and *regesto* Doc. 1442f; Old Sacristy: Pacciani, "Testimonianze per l'edificazione," 95, Doc. 14; and *regesto* Doc. 1422f; Saalman, *Filippo Brunelleschi: The Buildings*, 134, Pl. 72; and *regesto* Doc. 1428b; Moreni, *Continuazione*, vol. 2, 361–368; and *regesto* Doc. 1428b; Cappella degli Operai: Pudelko, "Per la datazione," 60, note 2; and *regesto* Docs. 1423c and 1427c; Cappella da Fortuna: Pacciani, "Testimonianze per l'edificazione," 95, Doc. 16; and *regesto* Docs. 1422b and 1424a; Saalman, *Filippo Brunelleschi: The Buildings*, 437, Docs. 2.1 and 2.2; and *regesto* Doc. 1427d; Cappella della Stufa: Saalman, , *Filippo Brunelleschi: The Buildings*, 441, Doc. 22; and *regesto* Doc. 1427b; Cappella dei Rondinelli: Moreni, *Continuazione*, vol. 2, 358–360; and *regesto* Doc. 1423d; Cappella degli Nelli: Elam, "The Site and Early Building History," 184, Doc. A; and *regesto* Doc. 1421b; and the construction hiatus in 1425 due to war: Ginori Conti, *La Basilica di S. Lorenzo*, 236–240; and regesto Doc. 1440c; and Gene Brucker, *The Civic World of Early Renaissance Florence* (Princeton, New Jersey: Princeton University Press, 1977), 466-467. The patronage of the Cappella di Luca di Marco was only allocated in 1433: Elam, "Cosimo de' Medici and San Lorenzo," 167, note 46; and *regesto* Doc. 1433a.

[166] Giovanni died on 28 February 1428 old style, or February 1429 modern style. Ruschi, "Una collaborazione interrotta," 76, note 39.

[167] Regarding sonnets composed by Brunelleschi to Donatello in protest of the latter's interventions, see: Manetti, *Vita*, ed. Tanturli, 110. By 1428 Donatello appears to have completed the four circular stucco reliefs set into the pendentives beneath the dome. Ruschi, "Una collaborazione interrotta," 72. Within the first half of the 1430s, Donatello and assistants appear to have completed the other four roundels, which depict the four evangelists, set into the four broad tympana below the dome. By 1443 Donatello appears to have collaborated with the sculptor and architect Michelozzo di Bartolomeo in the completion of the *scarsella* wall of the sacristy, which according to Manetti had been left incomplete. Although Manetti attributes the niches and the doors to Donatello, Ruschi argues that

stylistic evidence suggests the involvement of Michelozzo. Donatello and Michelozzo also appear to have jointly conceived the composition of the two Ionic, pedimented door surrounds of *pietra serena* that project from the *scarsella* wall, each surmounted by a large sculptural niche, and to have divided their execution between them: the stucco relief in the left niche, which depicts Saints Stefano and Lorenzo, to Donatello, and the relief in the right niche, which depicts Saints Cosmas and Damiano, as well as the two pedimented door surrounds, to Michelozzo. Ruschi, "Una collaborazione interrotta," 76; and Manetti, *Vita*, ed. Tanturli, 109-110.

[168] Moreni, *Continuazione*, Vol. 2, 361–368, and *regesto* Doc. 1428b; Ruschi, "Una collaborazione interrotta," 85 note 7, and *regesto* Doc. 1429a; and Carlo Sisi, "Due interventi di restauro sulle decorazioni in terracotta della Sagrestia Vecchia," in *Donatello e la Sagrestia Vecchia*, 86-90.

[169] On the variable quality of the nave capitals, see Cohen, "Ugly Little Angels," 276-289.

[170] See Cohen, "How Much Brunelleschi?," 35-36.

[171] A document of 1434 indicates that these Medici Chapel pilasters, complete with bases and capitals, must have been installed immediately after their manufacture. The document refers to "…pilasters made ready and erected on the upper side [i.e. in the transept], in other chapels in this church…", and later, to the "bases and capitals" thereof ("…secundum formam et qualitatem aliorum pilastrorum positorum et hedificatorum ex latere superiori in aliis capellis dicte ecclesie …cum basis et capitellis iusta formam predictam…"). Ruda, "A 1434 Building Programme," 358-361, and *regesto* Doc. 1434c. These Medici capitals belong to a distinct group distributed not only *inside* Giovanni's sacristy and chapel, but on the sides of these walls that are shared with adjacent chapels, thus indicating that Brunelleschi intended all capitals in this basilica to be uniform. As part of Giovanni's commission, therefore, Brunelleschi provided pilaster capitals that are today found not only inside the Old Sacristy and Medici double chapel, but inside the Cappella da Fortuna, and the Cappella degli Operai (Figure 2-1, SP 14-26). Whether the patrons of these two chapels later reimbursed the Medici for these capitals (Figure 2-1, SP 14, 15, 25 and 26) is unknown. Reflecting a similar situation, in 1423 an arbitrator resolved a dispute over shared funding for the wall that separates the da Fortuna and Rondinelli chapels. Moreni, *Continuazione*, vol. 2, 358–360; and *regesto* Doc. 1423b.

[172] Cohen, "How Much Brunelleschi?," 33-37.

[173] Ruda, "A 1434 Building Programme," 358-361, and *regesto* Doc. 1434c; Howard Saalman "San Lorenzo: the 1434 Chapel Project," *Burlington Magazine* 120, no. 903 (June 1978), 363. For Saalman's reconstruction of the proposed 1434 chapels, see *ibid*., 362-364; and Saalman, *Filippo Brunelleschi: The Buildings*, 147-152. In the latter work Saalman juxtaposes his axomometric drawing of his proposed chapel reconstruction opposite a photograph of the virtually identical

Cappella Carnesecchi of the church of Santa Maria Maggiore in Florence, without any verbal elaboration of the comparison. For Battisti's alternative reconstruction of the 1434 chapel project see Battisti, *Filippo Brunelleschi*, 186.

[174] Dale Kent, *Cosimo de' Medici and the Florentine Renaissance: The Patron's Oeuvre* (New Haven and London, 2000), 182

[175] Roberto Gargiani, *Principi e construzione nell'architettura italiana del quattrocento* (Roma-Bari, 2003), 42-43; and Arnaldo Bruschi, *Filippo Brunelleschi* (Milan, 2006), 110 (cites Gargiani).

[176] Ruda, "A 1434 Building Programme," 361; Saalman, "San Lorenzo: the 1434 Chapel Project," 361-364; and *regesto* Doc. 1434c.

[177] Calculated as follows: Since the present column plinths measure 2 br wide, and the present column diameters measure $1\frac{1}{2}$ br, the clear bay width is calculated as: $9\frac{2}{3}$ br (plinth to plinth) + 2 br (plinth width) = $11\frac{2}{3}$ br on center; $11\frac{2}{3}$ br on center - $1\frac{1}{2}$ (column diameter at widest entasis) = $10\frac{1}{6}$ br in the clear.

[178] The difference between $10\frac{1}{6}$ br and $10\frac{1}{8}$ br is about $\frac{1}{25}$ br (2.43 cm).

[179] Calculated as follows: If the distances between adjacent pairs of nave chapel pilasters and nave arcade columns had been $10\frac{1}{8}$ br in the clear, we would add one pilaster or column shaft width, 1 ½ br, to derive the on center distance, $11\frac{5}{8}$ br. We would then subtract one pilaster or column plinth width, 2 br, to derive the plinth to plinth distance, $9\frac{5}{8}$ br.

[180] Errors of similar magnitude are found elsewhere in the portions of the basilica completed under Brunelleschi's supervision for Giovanni de' Medici—i.e. in the double chapel under consideration and the adjacent Old Sacristy. The main room of the Old Sacristy, for example, measures very nearly 19 br square (1108.84 cm) with errors of 2.4 cm in width and 1.7 cm in length; and the total length of the sacristy, including the *scarsella*, measures very nearly 27 br (1575.72 cm) with an error of 3.4 cm. Cohen, "How Much Brunelleschi?," 40. I assume here that the length of the error itself, rather than the error calculated as a percentage of the total distance under consideration, is the significant figure to consider when comparing the construction accuracy in various parts of the basilica.

[181] According to Manetti, Brunelleschi, who was ever fearful that others would "discover his every secret" ("intendessi ogni suo segreto"), was notoriously ambiguous when documenting his designs in drawings and models, preferring instead to give verbal instructions directly to the masons as they

worked ("a bocca di mano in mano"). Indeed, Manetti specifically notes that "…he worked in this way at San Lorenzo…." Manetti, *Vita*, ed. Tanturli, 117.

[182] Hyman, "Fifteenth Century Florentine Studies," 113-117; and *regesto* Doc. 1434a.

[183] Isabelle Hyman, "Notes and Speculations on S. Lorenzo, Palazzo Medici, and an Urban Project by Brunelleschi," *Journal of the Society of Architectural Historians* 34 (1975), 98-120. Another possibility, which does not preclude the first, is that the piazza was intentionally created to open a view of the new basilica, a practice that Trachtenberg argues was well-established in late medieval Florence. Marvin Trachtenberg, *Dominion of the Eye: Urbanism, Art, and Power in Early Modern Florence* (Cambridge: Cambridge University Press, 1997).

[184] Ferdinand Schevill, *History of Florence: from the Founding of the City through the Renaissance* (New York: Harcourt, Brace and Company, 1936), 354-357; and A.D. Fraser Jenkins, "Cosimo de' Medici's Patronage of Architecture and the Theory of Magnificence," *Journal of the Warburg and Courtauld Institutes* 33 (1970), 165.

[185] Gene Brucker, *The Civic World of Early Renaissance Florence* (Princeton, New Jersey: Princeton University Press, 1977), 466.

[186] Manetti, *Vita*, ed. Tanturli, 108; and Elam, "Cosimo 'il Vecchio' de' Medici," 164.

[187] Schevill, *History of Florence*, Schevill, 359.

[188] Moreni, *Contnuazione*, vol. 1, 41–43; and *regesto* Doc. 1440b; Jonathan Davies, *Florence and its University During the Early Renaissance* (Boston: Brill Academic Publishers, 1998), 86; Hyman, "Fifteenth Century Florentine Studies," 94.

[189] "…vilipendium, et ignominiam totius dicti populi…." Ginori Conti, *La Basilica di S. Lorenzo*, 240–245; and *regesto* Doc. 1440c.

[190] "…hominibus, et personis, et dicti suprascripti homines…" *Ibid*.

[191] Saalman, *Filippo Brunelleschi: The Buildings*, 159–160.

[192] "…Per fare scoprire la chava del macigno di trassinaia." Hyman, "Fifteenth Century Florentine Studies," 431 and 524; and *regesto* Doc. 1442b. On 17 May 1442, Cosimo paid for the delivery of two and a half cartloads of stone from the quarry to the San Lorenzo construction site. *Ibid*., 431; and *regesto* Doc. 1442d.

[193] "…cappellamque maiorem et navem dicte ecclesie in medio existentem fere usque ad altare maius antiquum dicte ecclesie…" Ginori Conti, *La Basilica di S. Lorenzo*, 240–245; and *regesto* Doc. 1442e.

[194] Hyman, “Fifteenth Century Florentine Studies,” 435-437 and 320-324; and *regesto* Docs. 1442h-j. Another important detail pertaining to Cosimo’s commitment—how he planned to pay for the work—emerges from the ledger entries from this year. In a record of 12 September 1442, Cosimo transfers 40,000 florins to the *Monte Comune* in the name of the prior and chapter of San Lorenzo for a period of six years, on the condition that the interest on it be used for construction of the church. Hyman, “Fifteenth Century Florentine Studies,” 526; and *regesto* Doc. 1442g.

[195] Hyman, “Fifteenth Century Florentine Studies,” 439; and *regesto* Doc. 1442k

[196] “Regesto dei documenti,” in *Donatello e la Sagrestia Vecchia*, 103; and *regesto* Doc. 1442f.

[197] Hyman, “Fifteenth Century Florentine Studies,” 323-324, 332, 389, 447 and 464; and *regesto* Docs. 1443b-c.

[198] *Ibid*., 340, 544; and *regesto* Doc. 1447b.

[199] *Ibid*., 359, 362–363, 514, 520; and *regesto* Docs. 1449j and 1451a.

[200] *Ibid*., 337, 475; and *regesto* Doc. 1446c. Why five timbers were ordered rather than six, when six nave columns would soon be erected (see below), is not clear. Perhaps the scribe entered the wrong number, or perhaps the old basilica blocked the site of the sixth column, as shown in Figure 4-5 (Column 10 in Figure 2-1), and no decision had yet been made to partially demolish the old basilica in order to make room for it.

[201] *Ibid*., 337, 484, 538; and *regesto* Docs. 1446e-f.

[202] *Ibid*., 337, 344-45, 349, 358, 496, 511, 515-16, 538-43, 359-60; Hyman, "Notes and Speculations,” 117 Doc. 42; and *regesto* Docs. 1448a-c, e, i, k, l; and 1449c-i, k, l.

[203] Cohen, “Ugly Lilttle Angels,” 281; Hyman, “Fifteenth Century Florentine Studies,” 496 and 349; and *regesto* Doc. 1448e.

[204] Hyman, “Fifteenth Century Florentine Studies,” 361, 546; and *regesto* Doc. 1450b.

[205] Nevertheless, even if executed under Micelozzo’s supervision, the evidence presented above indicates that the nave arcades were built essentially as Brunelleschi intended them. We have seen that a key dimension in the nave arcade bay set of proportions, the springing height of the minor order arches and vaults, $17\frac{2}{3}$ br, appears to have been locked in upon completion of the Medici double chapel by 1429 (modern style) under Brunelleschi’s supervision. Cohen, “How Much Brunelleschi?,” 33-37. All the formal elements of the design, furthermore, are consistent with Brunelleschi’s other works, with the possible exception of the sculptural frieze reliefs in the entablature blocks, which could be additions by Michelozzo and Donatello. On the date of Brunelleschi’s death see Ugo

Procacci, “Chi era Filippo di ser Brunellesco?,” in *Filippo Brunelleschi: la sua opera e il suo tempo* (Florence: Centro Di, 1980), 55 note 30.

[206] Howard Saalman, “Tommaso Spinelli, Michelozzo, Manetti, and Rosselino,” *Journal of the Society of Architectural Historians* 25 (1966), 156. Scholarly opinion on the question of Brunelleschi’s involvement in the San Lorenzo project between 1442 (the re-commencement of construction under Cosimo de’ Medici) and 1446 (Brunelleschi’s death) varies. Roselli and Superchi, and Hyman leave open the possibility of Brunelleschi’s involvement, while Saalman favors his absence after 1429. Roselli and Superchi, *L’edificazione*, 23; Hyman, “Notes and Speculations,” 101-102; Idem, “Fifteenth Century Florentine Studies,” 136-37; Saalman, “San Lorenzo: the 1434 Chapel Project,” 363; and Idem, 156, 175.

[207] Saalman, “Tommaso Spinelli,” 156-157; and Saalman, *Filippo Brunelleschi: The Buildings*, 175.

[208] Giorgio Vasari in *Ragionamenti*, as quoted in Irving Lavin, “Donatello’s Bronze Pulpits in San Lorenzo and the Early Christian Revival” in *Past-Present* (Berkeley: University of California Press, 1993), 265 note 30.

[209] Cf. Burns’s comparison of the *scarsella* wall of the Old Sacristy with that of the Arena Chapel in Padua. Burns, “Quattrocento Architecture and the Antique,” 279.

[210] Hyman, “Notes and Speculations,” 101-105.

[211] Howard Saalman, *Filippo Brunelleschi: The Cupola of Santa Maria del Fiore* (London: A. Zwemmer Ltd., 1980), 284, Doc. 323.1.

[212] Lavin, “Donatello’s Bronze Pulpits,” 6; Howard Saalman in: Antonio di Tuccio Manetti, *The Life of Brunelleschi*, ed. Howard Saalman (University Park, Pennsylvania: Pennsylvania State University Press, 1970), 147 note 143; and Cohen, “How Much Brunelleschi?,” 37 note 62.

[213] Manetti, *Vita*, ed. Tanturli, 109; Hyman, “Fifteenth Century Florentine Studies,” 340, 474, 544; and *regesto* Docs. 1446b, 1446d, and 1447b.

[214] “Filippo l’adattò nella forma che la sta al presente.” Manetti, *Vita*, ed. Tanturli, 109.

[215] See Bernardo Talenti’s floor plan sketch of the San Lorenzo transept and an anonymous view of the transept decorated for the 1598 funeral of Filippo II, both reproduced in Pietro Ruschi, “Gli antichi altari maggiori di San Lorenzo,” *San Lorenzo, 393-1993, l’architettura, le vicende della fabbrica* (Florence: Alinea Editrice, 1993), 180 lower left. The 1598 view is reproduced more completely in Raffaella Corti, “Pontormo a San Lorenzo: Un episodio figurativo dello ‘spiritualismo’ italiano,” *Ricerche di storia dell'arte* 6 (1977), Fig. 1.

[216] Vasari, *Ragionamenti*, as quoted in Lavin, “Donatello’s Bronze Pulpits,” 13 and 13 note 30. Lavin suggests that as part of this comprehensive scheme, Donatello designed both Cosimo’s tomb, later

executed by Verrocchio; and the high altar, later executed by Desiderio da Settignano, although he allows that the latter two artists may have exerted their own influences on the final designs.

[217] Lavin, "Donatello's Bronze Pulpits," 15. Lavin's interpretation of the basilica of San Lorenzo as a deliberate evocation of the Roman basilica of San Lorenzo Fuori le Mura is consistent with the following assertion by the sixteenth-century chronicler Vincenzio Borghini: "There can be no doubt about this, and no hindrance to this opinion, that it [the Florentine church of San Lorenzo] stands outside the walls, indeed there is no need to consider it a fable, that the first Christians, when they were able to, endeavored deliberately to imitate in this area the things of Rome, which has the Church of San Lorenzo, and it is also called 'outside the walls.'" ("Non ci sarebbe questo dubio, ne s'impedirebbe questa opinione, che ella restasse fuor delle mura, anzi a un bisogno l'aiuterebbe; ne si creda favola, che que' primi cristiani, quando commodamente potevano, andavan volentieri imitando in questa parte, le cose di Roma, che havea la Chiesa di San Lorenzo, e così si chiama ancora extra Muros."). Vincenzio Borghini*, Discorsi di Don Vincenzio Borghini*, vol. 1 (Florence: Filippo e Iacopo Giunti, e fratelli, 1584), 299.

[218] Lavin continues: "The picture has another dimension as well. One must add to it the dome over the crossing, with the [two] pulpits placed at the corners, Donatello's four gigantic stucco sculptures of the evangelists, now lost, that stood in niches at the transept ends, and the coffered ceilings. The emphasis on plastic decoration and the powerfully centralized focus would have been downright Pantheon-like." Lavin, *ibid*., 15. For his description of the evangelist stuccos, Lavin cites Vasari's *Ragionamenti*. Lavin, *ibid*., 265 note 30. Lavin provides a drawing of his proposed reconstruction of the crossing square as Donatello intended it, with the curious omissions of the evangelist stuccos and the choir stalls—critically important features that Lavin notes elsewhere. Lavin, *ibid*. 7, Fig. 12. Lavin's crossing square reconstruction is in any case preferable to Saalman's, which depicts problematic configurations for the choir stalls, altar, and tabernacle; and two highly unlikely detached square fluted columns on the eastern side of the transept. Saalman, *Filippo Brunelleschi: The Buildings*, 161, Fig. 11. Neither Lavin nor Saalman acknowledge Clearfield's contentions that the three bronze gratings that surround Cosimo's tomb today "…are almost certainly not part of the original project," and probably date to 1738 (Figure 4-4). Janis Clearfield, "The Tomb of Cosimo de' Medici in San Lorenzo," *Rutgers Art Review* 2 (January 1981), 16 note 11. Both Lavin and Saalman include the gratings in their reconstructions, even reinstating the fourth (westernmost) one that no longer exists today, presumably removed when the present baroque altar steps were installed. Consistent with Lavin's overall proposal is Trachtenberg's observation of Early Christian revivalism inherent in Brunelleschi's San Lorenzo design. Marvin Trachtenberg, "On Brunelleschi's Choice:

Speculations on Medieval Rome and the Origins of Renaissance Architecture," in *Architectural Studies in Memory of Richard Krautheimer*, ed. Cecil L. Striker (Mainz: P. von Zabern, 1996), 169-173.

[219] The tomb slab in the floor of the crossing has been securely attributed to Verrocchio, and the subterranean tomb, tentatively so. Clearfield, *ibid*., 16 notes 11, 17, 20-22.

[220] The agreement was recorded on 13 August 1442. Ginori Conti, *La Basilica di S. Lorenzo*, 240–245; and *regesto* Doc. 1442e.

[221] Hyman, "Fifteenth Century Florentine Studies," 344, 538; and *regesto* Doc. 1448a.

[222] Saalman, *Filippo Brunelleschi: The Buildings*, 439 Doc. 9; Giovanni Gaye, *Carteggio inedito d'artisti dei secoli XIV, XV, XVI*, 3 vols, (Florence: Giuseppe Molini, 1839-1840),vol. 1 (1839), 167–169; and *regesto* Docs. 1456a, 1457b. Antonio di Manetto Ciaccheri (no relation to Brunelleschi's biographer, Antonio di Tuccio Manetti) is first referred to as "Antonio di Manetto, woodworker" ("antonio di manetto legnaiuolo") in a letter by Giovanni di Domenico da Gaiole to Giovanni de' Medici, dated 1 May 1457, or, immediately after the completion of the crossing dome (Gaye, *Carteggio inedito*, 167-169; and *regesto* Doc. 1457b). He is next referred to, but not named, by Antonio di Tuccio Manetti. Manetti, *Vita*, ed. Tanturli, 110-114. He had presumably replaced Michelozzo prior to 1457, perhaps at the beginning of work on the dome in 1451 or 1452. Hyman, "Fifteenth Century Florentine Studies," 362–363, 520; and *regesto* Doc. 1451a. Michelozzo's dismissal from work on the San Lorenzo dome perhaps coincided with his dismissal from the post of *capomaestro* of the cathedral cupola in 1452, where he was replaced by the same Antonio di Manetto Ciaccheri. Saalman, *Filippo Brunelleschi: The Cupola of Santa Maria del Fiore*, 143, 208-209, 286, Doc. 323.10. On Manetto Ciaccheri see Isabelle Hyman, "Towards Rescuing the Lost Reputation of Antonio di Manetto Ciaccheri," in *Essays Presented to Myron P. Gilmore*, ed. Sergio Bertelli and Gloria Ramakus, vol. 2 (Florence: La Nuova Italia, 1978), 261-280; Saalman, "Tommaso Spinelli," 155-158; and Hyman, "Fifteenth Century Florentine Studies," 362–363, 520.

[223] "...principio a edificare el Chiostro nuovo…" Saalman, *Filippo Brunelleschi: The Buildings* 439, Doc. 9; Moreni, *Continuazione*, vol. 1, 14; and *regesto* Docs. 1456a and 1457d.

[224] On the basilica of San Lorenzo as Cosimo's mausoleum see discussion above and Kent, *Cosimo de' Medici*, 377-384.

[225] The complete passage is as follows: "Domandato perché egli cominciava prima la casa che la chiesa, rispondeva che non sarebbe chi lo facessi, perché in molti sarebbono che farebono fare la chiesa, che non farebono fare la casa, sendo di magiore riputatione. Finita la casa, comincio a seguitare la chiesa, e fenne una buona parte inanzi che morissi." ("Asked why he began first the

cloister rather than the church, he replied that there would be no one who would do it, because there would be many who would want to build the church, but not the cloister, there being [in it] much greater prestige. Having finished the cloister, he commenced the continuation of the church, and he finished a good portion of it before he died.") Vespasiano da Bisticci, *Le vite*, vol. 2, 182.

[226] Elam interprets the passage in question, quoted in the preceding note, as a claim by Vespasiano that Cosimo began the cloister and canons' quarters as "his initial act," before building any other part of the basilica complex. Elam, "Cosimo de' Medici," 174. I prefer a more contextual reading of this passage, however. In 1457 virtually everyone in Florence must have known that Cosimo had just completed about half of the new basilica, which dwarfed the old one (then still standing in front of it) in size and magnificence. For these observers, Cosimo's decision to halt construction of the basilica and begin construction of the cloister (since both structures apparently could not be built simultaneously) must have been puzzling. Thus the question put to Cosimo that Vespasiano records would seem to have been both logical and justified. Vespasiano's note that after completing the cloister Cosimo "commenced the continuation" (*comincio a seguitare*) of the church, seems to support my interpretation, since only a church that had already been commenced could have a "continuation" (see note 225 above). Elam has advised me that Vespasiano's biographical account must be interpreted as a "moralizing story," though one that can perhaps be reconciled with actual events. Indeed, Cosimo's purported answer to the above question, as reported by Vespasiano, may be an elaboration upon Cosimo's actual reply, calculated to make Cosimo's decision appear driven more by philanthropic than pragmatic considerations.

[227] Vespasiano da Bisticci, *Le vite*, vol. 2, 192.

[228] Raymond de Roover, *The Rise and Decline of the Medici Bank: 1397-1494* (New York: W. W. Norton, 1966), 358.

[229] de Roover, *ibid*., 358-359.

[230] Nicolai Rubinstein, *The Government of Florence Under the Medici (1434 to 1494)*, 2nd ed. (Oxford: Oxford University Press, 1997), 155; and Alison Brown, 'Piero's Infirmity and Political Power,' in *Piero de' Medici 'il Gottoso': Art in the Service of the Medici*, ed. Andreas Beyer and Bruce Boucher (Berlin: Akademie Verlag, 1993), 9.

[231] Rubinstein, *ibid*., 155.

[232] "…disse che de' magiori erori avessi fatti mai, si era di non avere cominciato a spendere prima dieci anni; non aveva perché, conosciuta la natura della sua città, egli non sarebono anni cinquanta, che del suo né della casa sua non si truoverebbe nulla, se non quelle poche reliquie ch'egli aveva murate…." Vespasiano da Bisticci, *Le vite*, vol. 2, pp. 191-192.

[233] "Sollecitava questo edifitio con quanta celerità poteva, et sempre dubitava non essere a tempo." *Ibid*., 183.

[234] "Cominciata la libraria perché la sua volontà era ch'ella si facessi con ogni celerità possibile, e per danari non mancassi...." *Ibid*., 183. Vespasiano's comments quoted here suggest an alternative interpretation of a quotation presented by Kent, who writes: "Piero's note that as Cosimo lay dying he 'reminded me [Piero] of his often expressed desire to be buried in San Lorenzo' seems somewhat superfluous, in view of his father's previous arrangements, and was presumably rhetorical"; for in light of this discussion it seems that Cosimo may have had serious doubts as to whether his burial wishes would indeed be fulfilled. Kent, *Cosimo de' Medici*, 377.

[235] Aristotile notes that his stated fee would earn him little or no profit, but that he offers it for the opportunity to work in so notable a city for a family as illustrious as the Medici. Others who had considered hiring Aristotele for his expertise in moving or righting towers include Ludovico II Gonzaga, marquis of Mantua, and Pope Nicolas V. Michelangelo Gualandi, "Aristotele [sic] Fioravanti: meccanico ed ingegnere del secolo xv, memoria," *Atti e memorie della regia deputazione di storia patria per le privincie di Romagna* 9, 1870, 58-60; Luca Beltrami, *Vita di Aristotile da Bologna* (Bologna: Libreria Luigi Beltramini, 1912), 39-40; M. Eugène Müntz, *Les artes a la cour des papes pendant le xv et le xvi siècle: recueil de documents inèdits* (Paris: Ernest Thorin, 1878), vol. 1, p. 83; Howard Burns, "Leon Battista Alberti," in *Storia dell'architettura italiana: il quattrocento*, ed. Francesco Paolo Fiore (Milan: Electa, 1998), 164 n. 190; and *regesto* Doc. 1459b.

[236] Moreni, *Continuazione*, vol. 1, 14-16 and 14 note 3; Roselli and Superchi*, L'edificazione*, 128; *Donatello e la Sagrestia Vecchia*, 104; and Beck, 'Desiderio da Settignano," 215 note 3; and regesto Docs. 1461b-c.

[237] Vespasiano da Bisticci, *Le vite*, vol. 2, 182. See note 225, above. It is not likely that this passage refers only to the southern nave chapels, which were under construction in 1463, since these chapels were constructed by private individuals, not Cosimo. Roselli and Superchi*, L'edificazione…*, 104-124; and *regesto* Doc. 1463b.

[238] The complete passage reads: "Reliquit amore Dei, et pro utilitate anime sue Ecclesie, et Capitulo Ecclesie S. Laurentii de Florentia dimidium urcei olei, hoc est, medietatem unius barilis, sive lagene olei quolibet et pro quolibet anno in perpetuum cum onere, quod Prior, et Capitulum dicte Ecclesie teneantur, et debeant continuo tenere unam lampadem ad Oraculum, et ante Figuram Virginis Marie pictam, et sitam in secunda columna a dextris in introitu dicte Ecclesie, sive in columna, que est in dicta Ecclesia, propinquiori, et prope januam, per quam egreditur et itur recta linea in viam Stuphe, que lampas debeat continuo cum oleo retineri accensa: in hoc conscientiam Prioris, et dicti Capituli

strictissime onerando ec." ("Out of the love of God, and for the utility of his soul, he left to the church and chapter of the church of S. Lorenzo of Florence one half pitcher of oil, that is, a half a barrel, or bottle of oil each and every year in perpetuity with the obligation that the Prior and chapter of the said church should be held and must continually keep a light at the place of prayer and before the painted figure of the Virgin Mary, situated on the second column to the right of the entrance to the said church, or at the column, which is in said church, closer by, and near the door through which one goes out and proceeds in a straight line to Via della Stufa, which lamp should be kept continually replenished with oil: most strictly burdening the conscience of the prior and the said chapter in this matter.") Moreni, *Continuazione*, vol. 1, 133 note 1, and *regesto* Doc. 1464a. In formulating the preceding translation I benefitted from the assistance of Caroline Elam, Caroline van Eck and Jack Wasserman. This translation corrects and supersedes my previous translation in Cohen, "Ugly Little Angels," 286.

[239] In addition to the Orlando testament of 1464 (*regesto* Doc. 1464a) quoted in the preceding note, and the document of 1423 quoted in note 54 above (*regesto* Doc. 1423f), the following documents provided to me by Caroline Elam refer to a door in the old basilica located opposite Via della Stufa: a reference of 1420 to a *fornaio* (bakery) "in sul chanto della via della stufa dirimpetto alla porta della chiesa" (ACSL 1938, 36r; and *regesto* Doc. 1420a); a catasto of 1427 that refers to a chapel of Ser Giovanni Bonaiuti located "…by the door that goes into Via della Stufa" ("alato alla porta che va nella via della stufa"; Catasto 49, 453r; and *regesto* Doc. 1427f); and a decree by the signoria issued on 16 March 1434 ordering that a block of buildings adjacent to the basilica of San Lorenzo be demolished. According to Hyman, "the area to be levelled…ran from the palace of the della Stufa family on Via della Stufa, opposite the last portal of the old church ("contra ultimam portam dicte ecclesie"), to the shop of spice dealer Giusaffà in Via de' Ginori…." Hyman, "Notes and Speculations," 107; and *regesto* Doc. 1434a. Elam has also found a 1444 reference to "…the altar of St. Anthony at the porta della Stufa between two piers at the foot of St Gregory" ("l'altare di sto Antonio dalla porta alla stupha tra due pilastri a pie di Sto Gregorio"; ACSL 1938 36r; and *regesto* Doc. 1444a); and a note of 13 February 1445 (modern style) indicating that Lotteringho d'Andrea della Stufa was buried "…in the middle of the door of Via della Stufa" ("…nel mezzo alla porta della Stufa"; ACSL 1938 36v; and *regesto* Doc. 1445a).

[240] Elam documents twenty private chapels or chaplaincies in the old basilica, which, she notes, did not necessarily correspond to physical chapel spaces. Elam, "Cosimo de' Medici," 161-162 and Appendix A. For examples of agreements whereby families with chapels in the old basilica were permitted to build chapels in corresponding locations in the new basilica, see Moreni, *Continuazione*,

vol. 2, 358–360, and *regesto* Doc. 1423d; and the document of 18 May 1423 noted above (see note 54 above), and *regesto* Doc. 1423f. See also note 113 above.

[241] "...The chapels are newly under construction on the side by various citizens by diverse and various citizens on behalf of and at the pleasure of the venerable Cosimo de' Medici..." ("…le cappelle di nuovo simurono dallato dapiù e diversi cittadini e vari poplani in detta chiesa per chommessione e piacimento del venerabile chosimo de Medici...."). Roselli and Superchi*, L'edificazione…*, 104; and *regesto* Doc. 1463b. The familes taking part in the construction were the Aldobrandini, Taddei, Cambini, Neroni, and Maringnoli.

[242] A *sepoltuario* of 1653-55 lists chapel SP 3-SP 4 (Figure 2-1) as belonging to the heirs of Francesco di Niccolò de' Medici. Ginori Conti, *La Basilica di S. Lorenzo*, 79; and *regesto* Doc. 1653a.

[243] Evidently, not all the chapel holders in the old basilica could be counted on to build chapels in the new one. Cosimo's father, Giovanni de' Medici, also had difficulty assembling a sufficient number of chapel patrons to surround the nave with chapels, and thus ordered Brunelleschi to design the basilica without nave chapels. Manetti, *Vita*, ed. Tanturli, 108.

[244] Ginori Conti, *La Basilica di S. Lorenzo*, 72–73; and *regesto* Doc. 1465a.

[245] This hypothesis that Cosimo had trouble assembling chapel patrons is consistent with Saalman's interpretation of the 1434 chapel project as an attempt by a rebellious group of families to wrest control of the church from the Medici, who were then in exile. Saalman, *Filippo Brunelleschi: The Buildings*, 147; and Saalman, "San Lorenzo: the 1434 Chapel Project," *Burlington Magazine* 120 (1978), 363.

[246] See note 222 above.

[247] On 29 July 1446, payment was recorded in the Medici construction ledger for "…6 large columns of macigno which must be made" ("…6 colonne grandi di macigno ci debono fare"). On 3 February 1448 (modern style), the first nave column shaft was delivered to the construction site from the quarry. Hyman, "Fifteenth Century Florentine Studies," 337, 344, 538; and *regesto* Docs. 1446e and 1448a.

[248] For detailed descriptions of these carved details see Cohen, "Ugly Little Angels," 276-285.

[249] In the western three bays, for example, column heights vary by no more than 1.6 cm from one to the next. In the eastern five bays these heights vary by as much as 14 cm. Cohen, 'How Much Brunelleschi?," 22, Fig 4, and Appendices 2 and 4; and Cohen, "Ugly Little Angels," 279, Fig. 4.

[250] Morolli attributes what he perceives to be a progressive decline in sculptural quality during the course of the second phase to a "growing disinterest" on the part of Piero de' Medici, and later

Piero's son Lorenzo, in the early *quattrocento* style of the basilica. Morolli, however, does not illustrate his observations, and I am unable to discern any such progressive decline in quality within the eastern five nave bays. Gabriele Morolli, "L'ordine Brunelleschiano: morfologia e proporzioni," in *San Lorenzo, 393-1993, l'architettura, le vicende della fabbrica*, eds. Gabriele Morolli and Pietro Ruschi (Florence: Alinea Editrice, 1993), 85-89; and Morolli, "Non solo Brunelleschi," 102.

[251] On Pagno see: H. W. Janson, 'Two Problems in Florentine Renaissance Sculpture,' *Art Bulletin* 24 (1942), 326-329; Saalman, *Filippo Brunelleschi: The Buildings*, 194; Hyman, "Fifteenth Century Florentine Studies ...," 139-144, 394-397; and Hyman, "Notes and Speculations," 111, and 117 Docs. 41-44.

[252] Franco Borsi, Gabriele Morolli, and Francesco Quinterio, *Brunelleschiani* (Rome: Officina Edizioni, 1979), 275; Eugenio Casalini, *La SS. Annunziata di Firenze* (Firenze: Convento della SS. Annunziata, 1971), vol. 1, 32 note 13, and 29 note 7; and *regesto* Docs. 1461f, 1462a.

[253] Howard Saalman, "The Palazzo Comunale in Montepulciano: An Unknown Work by Michelozzo," *Zeitschrift für Kunstgeschichte* 28 Bd., H. 1/2 (1965), Appendix II, 44-46; and Hyman, "Fifteenth Century Florentine Studies," 431, 524.

[254] An inscription on the tabernacle identifies Pagno as the master of the work. Hyman, *ibid*., 142; and Janson, "Two Problems," 327.

[255] At least one of the capitals was probably made for the basilica. Hyman, "Notes and Speculations," 101-105, 111, and 117 Doc. 41.

[256] Hyman, "Notes and Speculations," 111 and 117, Docs. 41-44.

[257] On the latter point see Saalman, "The Palazzo Comunale in Montepulciano," 6-10.

[258] Linda Elaine Neagley, *Disciplined Exuberance: The Parish Church of Saint-Maclou and Late Gothic Architecture in Rouen* (University Park, Pennsylvania: Pennsylvania State University Press, 1998), 107.

[259] *Ibid*., 111.

[260] *Ibid*.

[261] *Ibid*.

[262] *Ibid*., 112-113

[263] Hyman, "Fifteenth Century Florentine Studies," 297-547. The most egregious examples of low-quality stonecarving in the nave of the Basilica of San Lorenzo are found in the dark northern side of the north arcade, where the sun never illuminates them. Cohen, "Ugly Little Angels," 279-283. The concerns of the fifteenth-century church builders in France and Italy with the careful balancing of time, quality and money, as discussed here, reflect a broader cognitive shift in western European

thought. That broader shift, according to Alfred W. Crosby, was characterized by an increasing emphasis on precision, quantification and mathematics after about 1250, a shift that he describes in terms of a "Venerable Model" and a "New Model." Alfred W. Crosby, *The Measure of Reality: Quantaification and Western Society, 1250—1600* (Cambridge: Cambridge University Press, 1997), 21-47, 227-240; and Cohen, "Quantification and the Medieval Mind," 23-30.

[264] "…le cappelle che al presente sono murate dalla parte del chiostro…." Roselli and Superchi, *L'edificazione*, 104-124; Ginori Conti, *La Basilica di S. Lorenzo*, 72–73; and *regesto* Docs. 1463b, 1465a

[265] Moreni, *Continuazione*, vol. 1, 117 note 1 (provides a date for the codicil of 8 July, 1479); Roselli and Superchi, *L'edificazione*, 128 (provide a date for the codicil of 8 July, 1475); and *regesto* Doc. 1479a.

[266] Roselli and Superchi, *L'edificazione*, 128; and *regesto* Doc. 1469b. Note that Ughi's name does not appear in a *sepoltuario* of 1653-55 that lists the patronage of all chapels in the church at that time, and which forms the basis for many of the patronage labels in Figure 2-1. Ginori Conti, *La Basilica di S. Lorenzo*, 76-79; and *regesto* Doc. 1653a. Whether the Ughi family ever succeeded in building a chapel in the church is unknown.

[267] "…danneggiata dai lavori eseguiti nella chiesa." Roselli and Superchi, *L'edificazione*, 129; and *regesto* Doc. 1470a.

[268] Hyman, "Fifteenth Century Florentine Studies," 325-365, 534-547.

[269] I do not find Saalman's theory of a "gradual demolition of the old basilica to make way for the building of the projected nave" to be plausible. Saalman, *Filippo Brunelleschi: The Buildings*, 188. Although I have proposed above that the high altar chapel and perhaps other limited portions of the west end of the old basilica were demolished in the 1440s to accomodate the construction of Column 10, according to my proposal the old basilica would have been patched and repaired just once, and then remained in service for at least another two decades. According to Saalman's proposal, the old basilica would have to have been partially demolished, patched and repaired several times in rapid succession as the new nave progressed. Thus, the old basilica would have become ever smaller, less functional and more inconvenient to the workers as the construction site continued to shrink. All that work on a building that would soon be demolished also would have consitituted a substantial expense with no long-term benefit. A total, rapid demolition in about 1465 is more likely.

[270] Reference provided by Caroline Elam, from Peggy Haines. See *regesto* Doc. 1477a.

[271] Saalman, *Filippo Brunelleschi: The Buildings*, 439, Docs. 12.1, 12.2; and regesto Doc. 1481a.

[272] On the date of the northern side door, see Hyman, "Fifteenth Century Florentine Studies," 350–351, 497; and *regesto* Doc. 1448f.

[273] Saalman, *Filippo Brunelleschi: The Buildings*, 439, Docs. 13.1, 13.2, 14.1; and *regesto* Docs. 1484a-c.

[274] Elam, "The Site and Early Building History," 162.

[275] Gino Corti, "Una ricordanza di Giovan Battista Figiovanni," *Paragone* 15, No. 1175 (1964), 28; Sheryl E. Reiss, "The Ginori Corridor of San Lorenzo and the Building History of the New Sacristy," *Journal of the Society of Architectural Historians* 52 (1993), 339 note 3; Elam, "The Site and Early Building History," 174, note 24, and 185, Doc. E; Ginori Conti, *La Basilica of S. Lorenzo*, 82–83; and *regesto* Docs. 1519a, 1520a, 1457e.

[276] The pilasters behind them, however, FP 11 and 12 (Figure 2-1), can be securely dated to the fifteenth century based on stylistic evidence. On the *Tribuna*, see: Federica Salvi, "Michelangelo Buonarroti e la Tribuna delle Reliquie," in *San Lorenzo, 393-1993, l'architettura, le vicende della fabbrica* (Florence: Alinea Editrice, 1993), 115-118; and Mauro Mussolin, "La tribuna delle Reliquie di Michelangelo e la controfacciata di San Lorenzo a Firenze," in *Michelangelo architetto a San Lorenzo*, ed. Pietro Ruschi (Florence: Mandragora, 2007), 183-199.

[277] The belfry was completed in 1741. Valerio Tesi, "Il nuovo campanile," in *San Lorenzo, 393-1993, l'architettura, le vicende della fabbrica* (Florence: Alinea Editrice, 1993), 156.

[278] Valerio Tesi, "I restauri di Gaetano Baccani," in *San Lorenzo, 393-1993, l'architettura, le vicende della fabbrica* (Florence: Alinea Editrice, 1993), 163-164.

[279] *Ibid*., 164.

[280] Giulio Carlo Argan, "The Architecture of Brunelleschi and the Origins of Perspective Theory in the Fifteenth Century," *Journal of the Warburg and Courtauld Institutes* 9 (1946), 112-113; and Argan, *Brunelleschi* (Verona: Mondadori, 1955), 79.

[281] Rudolf Wittkower, "Brunelleschi and 'Proportion in Perspective,'" *Journal of the Warburg and Courtauld Institutes* 16 (1953), 289; and Paatz, *Die kirchen*, 478.

[282] See note 81. For the term "metrical coherence" and variations thereof in relation to the work of Brunelleschi, see *ibid*., 132-133, 275-291.

5. Medieval Origins

The sets of proportions described in Chapters 2 and 3 have provided the first new impetus for progress in our understanding of the construction history of the basilica of San Lorenzo in many years. We have not yet exhausted the historical value of these new proportional discoveries, however. By providing new evidence of the design intentions of Matteo Dolfini and Filippo Brunelleschi when they made their successive contributions to the design of the basilica, these newly-identified sets of proportions now provide evidence highlighting two likely medieval precedents for important aspects of the designs of not only the basilica of San Lorenzo, but Santo Spirito as well.

5.1. The Lombard Connection

> "…la sagrestia si tirò innanzi avanti a ogni altra cosa, e tirossi su di condizione, che la faceva stupire tutti gli uomini e della città e forestieri a cui accadeva el vederla, per la sua nuova foggia e bella. E concorrevavi continovamente tanta gente, che davano grandissima noia a chi vi lavorava."[1]

This account of the enthusiastic public reception of Filippo Brunelleschi's Old Sacristy as it reached completion in the late 1420s, even if perhaps embellished by Brunelleschi's admiring biographer to enhance the architect's reputation, is a remarkable record of the novelty and aesthetic appeal of Brunelleschi's early Renaissance style according to one later fifteenth-century resident of Florence.[2] Indeed, the account is not hard to believe, for the sacristy continues to be filled with admiring visitors today. The universal appeal of Brunelleschi's unique style has inspired many scholars to explore its formal origins. What precedents did Brunelleschi assemble as inspirational raw materials, and how did he meld them into such an artistically expressive and influential form of architecture?

Studies of the origins of Brunelleschi's style have, since the late nineteenth century, focused on two perceived characteristics of it. The first is the evident revival and synthesis of earlier architectural forms—though exactly what forms Brunelleschi revived and synthesized has been a matter of extensive discussion and evolving opinion. The second is the evident contrast in overall character between Brunelleschi's early Renaissance style and the Gothic style that preceded it, a quality that scholars often attribute in substantial part to Brunelleschi's purported use of mathematically rational and grid-based sets of architectural proportions.[3] The present study expands this ongoing discussion by examining some new possible design precedents for the basilicas of San Lorenzo and Santo Spirito that have never before been considered in this context. It furthermore expands this discussion by accepting the likelihood that Brunelleschi based much of his design for the San Lorenzo/Old Sacristy complex, including including its sets of proportions, on an earlier, partially-executed design by the church prior Matteo Dolfini.[4] It therefore considers the possibility that both Dolfini and Brunelleschi might have brought certain design influences from earlier buildings into the present San Lorenzo design. This study, furthermore, benefits from a new approach to the problem of sets of architectural proportions in the works of Brunelleschi.

Most of the design precedents newly proposed in this study have come to my attention as indirect products of my previous studies of the sets of proportions found in the basilicas of San Lorenzo and Santo Spirito in Florence.[5] Those studies consider sets of architectural proportions to be genuine historical artifacts that cannot, due to the nature of such sets, have had any significant influence on architectural appearances.[6] The present study builds upon that assumption by using the sets of proportions found in the basilica of San Lorenzo as a non-visual primary source that can call attention to promising new architectural comparisons. Once those comparisons are identified, the visual evidence in the comparisons themselves carries the weight of the argument. In this way, our attention is drawn to a northern region that scholars have not previously considered as a possible source of significant design influence on the seminal works of Florentine early Renaissance architecture.

Brunelleschi the Synthesizer

One of the earliest and most widespread scholarly views of Brunelleschi found in the literature frames the architect as the one singlehandedly responsible for the *renovatio* of ancient Roman architectural forms and principles following a pejorative Gothic interlude. This view has reached us, by way of the scholarship of the late nineteenth and early twentieth centuries, from Giorgio Vasari's sixteenth-century *Le Vite*, and ultimately from one of Vasari's own sources, the fifteenth-century *Vita* of Antonio di Tuccio Manetti.[7] Manetti furthermore notes that Brunelleschi sought to revive not only the Romans' way of building, but "[…] le loro proporzioni musicali […]."[8] Ever since Carl von Stegmann and Heinrich von Geymüller attempted to identify modular proportions in the Basilica of San Lorenzo in 1883, and especially since the appearance of Rudolf Wittkower's article "Brunelleschi and 'Proportion in Perspective'" in 1953, many scholars have adopted the view, closely related to the above-noted one, of Brunelleschi as the architect of "metrical coherence"; a view that assumes that pre-Brunelleschi medieval architecture was not metrically coherent.[9]

A dissenting nineteenth-century view, introduced by Dehio and inspired by a different reading of Vasari, proposes another kind of *renovatio* as Brunelleschi's main design interest: the revival of classicizing Tuscan Romanesque style forms, to the exclusion of ancient Roman forms.[10]

This theme is further developed by Fontana, who insists that Brunelleschi conceived his style not "…in Roma sugl esemplari classici, bensì in Firenze ed altrove su fabbriche medioevali di carattere romanico…".[11] Most recent scholarship (i.e., that produced by living scholars) has continued to explore this medieval Tuscan theme, while also broadening the scope of investigation to include extra-Tuscan sources, and reconsidering the question of possible Roman influences. Thus, while Hoffman and Horster have reexamined the ancient Roman theme in relation to Brunelleschi's work, Bruschi, Burns, Klotz, Murray, Saalman, Schedler and Trachtenberg have explored possible Tuscan Romanesque and *trecento* Tuscan Gothic influences. Burns and Bruschi furthermore note certain relationships between Brunelleschi's buildings and architectural depictions in *trecento* frescoes.[12]

Looking beyond both Rome and Tuscany, Burns notes the striking formal and documentary links between the Old Sacristy of San Lorenzo and the Romanesque Baptistery of Padua Cathedral, in addition to other possible connections between works attributed to Brunelleschi and medieval buildings in Venice and the Veneto.[13] Elaborating upon the observations of Fabriczy, Fontana and Burns, Hyman illuminates a wide range of stylistic and structural affinities between the works of Brunelleschi and "eastern Early Christian, Venetian and Byzantine, Persian and Islamic structures."[14] Trachtenberg later explores possible Byzantine connections in more detail.[15] These Eastern explorations are of particular interest in light of Sanpaolesi's ambitious and well-documented comparison between Brunelleschi's cupola of the Cathedral of Florence and the massive, double-shelled, pointed dome of herringbone brickwork enclosing the mausoleum of Ilkhan Ulgiaitu in Soltanieh, Iran (1304-1312).[16]

Following its demotion in most Brunelleschi literature in favor of attention to Tuscan and other sources, Roman civilization has recently reentered broad scholarly discussion of Brunelleschi's possible influences. While Hyman proposes that Brunelleschi may have derived much of his classicism from the Early Christian basilicas of Ravenna, Lavin draws connections between the Brunelleschi basilicas and the Early Christian basilicas of Rome itself, as does Trachtenberg, who argues that Brunelleschi's references to the Early Christian basilica were consistent with the medieval Roman tradition of recreation of that building type; an argument that brings us back to the question of ancient Rome.[17] Which Rome, if either, did Brunelleschi reference?

Believing that Brunelleschi's work betrays no evidence of direct quotation from ancient Roman architecture, some scholars embrace an extreme position of total Brunelleschi-in-Rome denial: the belief that Brunelleschi was not only not influenced by Roman architecture, but that he never set foot in the city.[18] This position, however, has much contrary evidence to contend with. There is, for example, the small figure of the *spinario* in Brunelleschi's bronze competition panel of 1401, which is but a clothed and mirror-image replica of the famous Roman statue that may have been displayed outside the Lateran basilica in Brunelleschi's day.[19] There are, furthermore, the Cathedral of Orvieto's projecting semi-cylindrical chapels, slit by tall round-headed windows, that are strikingly similar to those of Brunelleschi's Basilica of Santo Spirito as originally planned.[20] Located between Florence and Rome, Orvieto and its impressive medieval cathedral would have been a convenient and rewarding rest stop for fifteenth-century artists travelling between the two cities (Figure 5-1), which is exactly what Vasari tells us Donatello once used it for.[21] Finally, there is the continual traffic that flowed between Florence and Rome in Brunelleschi's day.

Even if one chooses to reject Manetti's claim that Brunelleschi lived in Rome between about 1409 (or earlier) and 1419 and made numerous trips to Florence, the claim itself indicates that such extensive travel between the two cities was physically and culturally possible in the fifteenth century, at least for persons of sufficient stamina and means.[22] We may similarly interpret Vasari's note that Brunelleschi once trudged off from Florence to Cortona (about one-third of the way to Rome) to examine a Roman sarcophagus and returned before anyone realized he had gone.[23] In 1434 Brunelleschi's adoptive son, il Buggiano, absconded all the way to Naples with his master's money and jewels, and was returned to Florence only after the Pope, at Brunelleschi's urging, issued a bull entreating the Queen of Naples to intervene.[24] Thus Trachtenberg is indeed justified in declaring that "[…] the burden of proof falls on those who would *deny* Rome to Brunelleschi […]."[25]

Burns demonstrates that there is no contradiction in observing the evident lack of direct quotation from antique Roman sources in Brunelleschi's work while also accepting the likelihood that Brunelleschi spent extensive time in Rome. He thus reconciles his statements that "[...] Brunelleschi is the true reviver of much of the spirit of ancient architecture" and "[…] there is not a single major work of Brunelleschi for which a plausible and specific post-antique source (or sources) cannot be suggested", by arguing that "the idea of antique architecture as a set of principles, rather than precedents, is implicit in Brunelleschi's buildings […]."[26] Indeed, Brunelleschi's stylistic synthesis, no mere cut-and-paste collage, requires of us an alertness to principle as well as precedent, and an acknowledgement of the important role travel played in satisfying Brunelleschi's voracious curiosity about art and architecture.[27]

In light of the preceding discussion, we must assume that Brunelleschi was open to learning from both Romes, pagan and Christian, and similarly both Florences (in light of his probable belief that the Baptistery of Florence was Roman), along with many other sources of architectural inspiration. Thus, in accordance with this view of Brunelleschi's style as the product of wide ranging design synthesis, Trachtenberg notes that for Brunelleschi, "the past, Roman and otherwise, was […] a vast landscape of architectural resources that he selectively mined for highly original purposes."[28] A map highlighting Brunelleschi's possible source locations referred to thus far (and a few more to be discussed below) reveals the impressive geographical range of his apparent design synthesis (Figure 5-1). It also reveals a curious gap. Tuscany, Rome, the Veneto, and the East contained a diverse wealth of architectural forms from the years preceding Brunelleschi's lifetime, but what about the major architectural activity underway *during* his lifetime?

Construction of the Cathedral of Florence up to the tambour served as the primary backdrop of architectural construction activity to Brunelleschi's childhood and young adulthood, and both Brunelleschi and his father served on various citizen construction committees associated with it.[29] Studies examining certain similarities between the Cathedral of Florence and the buildings of Brunelleschi have been cited above, but given the stylistic gulf that separates the cathedral from Brunelleschi's early Renaissance style, the former hardly seems to have provided a significant source of inspiration for the latter. Furthermore, before Brunelleschi's own activities turned the cathedral cupola project into an architectural laboratory that drew, according to Manetti, "[…] masters, architects, masons, and master engineers from all of Christendom […]," construction of the cathedral appears to have been primarily of local interest, involving little if any architectural innovation of note.[30] The same cannot be said of architectural activity in Lombardy during the late fourteenth and early fifteenth centuries.

Lombard Architectural Innovations

In 1386 the Cathedral of Milan was founded, an event that symbolized the cultural and economic resurgence of Lombardy under the leadership of Gian Galeazzo Visconti (ruled 1378-1402). The scale and structural ambition of the Duke's proposed new cathedral exceeded the capabilities of the Lombard masons and, apparently, the technical complexity of the Cathedral of Florence before the cupola became the main focus of attention. Milanese officials thus organized convocations of master masons, engineers, and other experts from Italy and north of the Alps in 1392, 1400, 1401 and later to resolve significant technical issues. So impressive was this architectural activity in Milan that in 1390 the *comune* of Bologna sent the architect Antonio di Vincenzo to study the nascent Cathedral of Milan pursuant to its own ambitious project for the great civic Basilica of San Petronio.[31] Antonio was probably just one of numerous architectural pilgrims who made their way to Milan and other Lombard cities during the late fourteenth and early fifteenth centuries to study this cathedral and several other major works. Brunelleschi (1377-1446) came of age during this period of Lombard distinction in Italian architecture and, trained as a goldsmith at a time when goldsmiths and other artists and artisans were frequently called upon as advisers on architectural matters, he surely kept abreast of architectural developments in Lombardy and elsewhere. Indeed, long before he became *capomaestro* Brunelleschi served as an adviser to the

Opera of the Cathedral of Florence in 1404, and perhaps later to the *Opera* of the Cathedral of Milan as well.[32] The sixteenth-century chronicler Antonio Billi notes one trip by Brunelleschi to Milan (possibly datable to about 1420, if indeed it occurred) at the invitation of Filippo Maria Visconti to advise on the construction of a fortress.[33] That Brunelleschi respected the construction prowess of the Lombards, even while evidently serving as an advisor to them, is implied in Manetti's report that as *capomaestro* of the Florentine cupola he broke a strike of construction workers by hiring "[…] 8 lombardi […]," perhaps in reference to the supervising master masons who Manetti notes were assigned one to each side of the octagonal structure.[34] Brunelleschi's apparent respect for contemporary Lombard architecture also helps to explain his reaction to an alteration that according to Manetti he was compelled to make to his predecessor's design for the Basilica of San Lorenzo.

In about 1480 Giuliano da Sangallo, a follower and younger contemporary of Brunelleschi, made a sketch that shows the floor plan of the Basilica of San Lorenzo much as it appears today, but lined with nave chapels twice as deep as the present ones (Figure 3-5).[35] Earlier in this study I have provided new evidence that Giuliano's deep nave chapels in this sketch not only reflect Brunelleschi's preferred San Lorenzo design, but the one he inherited from Dolfini (Figures 3-16 and 4-15).[36] According to Manetti, when Brunelleschi took over the project around 1421, probably at Dolfini's death, he removed these nave chapels on the orders of Giovanni de' Medici who, Manetti claims, had patron-like authority over the project. Giovanni did so, Manetti continues, because he was unable to find enough citizens willing to build them. According to Manetti Brunelleschi did so "[…] malvolentieri, perché la gli pareva cosa misera […]."[37] Manetti apparently shared Brunelleschi's favorable opinion of Dolfini's chapels, for he laments that "[…] 'l corpo della chiesa dalla croce in giù, che non è conforme alla detta croce […]", an apparent indication that the *present* nave chapels, built after 1457, are not as deep and as tall as Brunelleschi, following Dolfini, intended.[38] Dolfini's deep nave-chapel scheme appears to have been quite progressive for its day.

The two rows of deep nave chapels in Dolfini's plan transform the conventional Latin Cross medieval basilica type from a cruciform building in space, to a rectangular block from which is carved a cruciform negative space (Figure 3-16). They also provide an elegant solution to the increasing demand in late medieval urban culture for family chapels by a growing class of merchant patricians.[39] This spatial and social transformation of the basilica building type had previously appeared in Florence in the late fourteenth-century reconstruction of the Basilica of Santa Trinita, though this small, dimensionally irregular church hardly seems architecturally compelling enough to have served as the model for the first major basilica to be initiated in Florence in over a century (Figure 5-2). It lacks the confident geometrical clarity of Dolfini's San Lorenzo scheme, perhaps due to its severe site constraints, and provides an unremarkable interior experience.[40] The existence of a common source for both basilicas seems more likely. Manetti's note that Dolfini began his project "[…] di pilastri di mattoni […]" offers a possible hint that the source might not have been Florentine.[41] Brick was an unusual primary building material in medieval Florence, but common in the north.[42] Indeed, in Dolfini's day the largest basilica construction project underway near Florence was Antonio di Vincenzo's aforementioned Basilica of San Petronio in Bologna, which is built entirely of brick. The enormous basilica that we see today was originally intended to constitute just the nave of an even larger cruciform structure, and Florentine architects must have been familiar with the project.[43] It displays a modular, deep nave chapel scheme very similar to that of Dolfini's San Lorenzo, the only significant difference between them being the elimination of alternate nave piers in the Bologna basilica (Figure 5-3), where the Dolfini/Brunelleschi plan has uninterrupted rows of point supports (Figure 3-16).[44] The deep nave chapel scheme, however, does not appear to have originated with Antonio either.

The drawings that Antonio di Vincenzo made in 1390 provide a record of the projected design of the Cathedral of Milan just four years after groundbreaking and indicate that the design of the Basilica of San Petronio owes a significant debt to it, particularly in the way the cross-section rises from a five-bay-wide nave.[45] Other aspects of the Bologna design indicate, however, that while Antonio may have been sent to Milan to examine the cathedral works, he came home equally impressed by another basilica under construction nearby. Architectural pilgrims from central Italy who made their way to Milan during the late fourteenth and early fifteenth centuries would have been sure to visit Pavia, just 35 kilometers to the south (Figure 5-1). Pavia boasted numerous impressive Romanesque churches harking to the city's past distinction as capital of the Longobard kingdom (7th to 12th centuries), and several major new works attesting to the city's then-current distinction as the seat of the powerful Visconti dukedom.[46] The most impressive of the new works were designed by the Visconti court architect, Bernardo da Venezia.[47] These works include the Castello di Pavia (the duke's residence), begun c. 1370 under Galeazzo II Visconti (ruled 1354–1378); the basilica of Santa Maria del Carmine in Pavia, begun c. 1373; and the Certosa of Pavia, a vast monastic complex begun in 1396 under Gian Galeazzo Visconti to house the ducal tombs.[48] One of these works appears to have attracted the sustained attention of the architectural community of northern and central Italy for many decades after its first vaults began to rise.

The Basilica of Santa Maria del Carmine in Pavia is a compact yet imposing basilica, characterized on the outside by a low, broad, box-like form, and on the inside by weighty, closely spaced clusters of brick columns, colonnettes, and piers (Figure 5-4). The blunt, curving surfaces of the engaged columns and cushion capitals of the minor order, the restrained use of ornament (confined to the major order column capitals), the slightly pointed arches of varying sizes, and the lucid geometrical logic throughout create a unique spatial experience that conveys seemingly contradictory impressions of strength, solidity, and lightness. From certain vantage points the basilica appears to have been carved from a living mountain of brick. From others it appears strangely ephemeral, its upper regions dematerialized by blank expanses of smooth white plaster. Much of this emotive impact of the design comes from an aspect of regulation and discipline that seems driven by a latent but deliberate classicism.

Comparison of the repeating interior elevations of the Santa Maria del Carmine and San Petronio nave bays suggests that Antonio admired the forceful and compositionally efficient design of the Carmine bays, and copied it directly. He appears to have merely increased the bay width slightly relative to its height, enlarged the oculus, and modified the forms of the pier shafts and capitals perhaps based on those of the Cathedral of Florence (Figures 5-5 and 5-6).[49] Antonio's admiration for the Carmine of Pavia may have stemmed in part from his ability to observe a substantial portion of it already standing. At the time of his visit to the Cathedral of Milan, after all, there was little to observe but some unfinished foundations, tentative intentions, and a host of rancor.[50] The Carmine of Pavia, by contrast, about seventeen years into construction under the direction of a single, politically powerful architect, was probably already displaying imposing vaulted spaces.

Floor plan comparisons suggest that the Carmine may have served not only as the source of Antonio's deep nave chapel scheme (Figures 5-3 and 5-7), but more significant for this investigation, as the model for Dolfini's entire San Lorenzo floor plan, not including the double chapels at the ends of the transept (Figures 3-16 and 5-7).[51] While we have no information regarding the shapes and sizes of the nave piers or columns that Dolfini intended for his San Lorenzo design before Brunelleschi turned them into monolithic columns of *pietra serena*, and while my comprehensive survey of the Carmine floor plan has thus far revealed no significant proportional similarities with my reconstructed Dolfini floor plan, the two plans are nevertheless schematically virtually identical.[52] With appendages removed, as shown in Figures 3-16 and 5-7, both consist of rectangular perimeters broken only by square high altar chapels; both have four transept chapels and sixteen nave chapels, all identical; both contain cruciform spines conceptually composed of eight large squares, one each for the crossing square, high altar chapel and each transept arm, and four for the nave; and both are based on a conceptual module corresponding to one of these large bays—let us say the crossing square—in which could fit four of the chapels, approximately if not exactly.

Antonio di Vincenzo's and Matteo Dolfini's apparent interests in the designs of the Cathedral of Milan and the Carmine of Pavia anticipated Brunelleschi's own apparent architectural investigations in Lombardy. The Basilica of Santo Spirito (Figure 5-8) and the Cathedral of Milan

(Figure 5-9), although dissimilar in scale and style, share several fundamental characteristics. In plan, both have rows of freestanding columns arranged on regular grids on center—an 11 br. grid at Santo Spirito and 16 br. at the Cathedral of Milan—that are echoed by peripheral rows of identical engaged columns.[53] In both buildings these columnar arrays create impressions of freestanding, hypostyle hall-like skeletal structures that resemble formerly open-air pavilions that have seemingly been enclosed by walls only due to functional necessity. Perhaps most significant, both have such similar numbers and arrangements of bays, columns and engaged columns that the Cathedral of Milan floor plan, with a few minor modifications, could have served as the template for the simplified and more regularized Basilica of Santo Spirito floor plan.[54]

If we imagine the outermost side aisles of the Cathedral of Milan nave divided up into chapels—as appears to have been originally intended (see below)—then both this basilica and that of Santo Spirito would have three-bay wide naves, transept arms, and apses, the outermost bays of which form continuous ambulatories that lead worshippers in from either side door in the façade, down the aisle, around the transept and apse, and out through the other aisle. Furthermore, counting outwardly from the crossing piers, both basilicas have nine-bay long naves, three-bay long transept arms; and, if we exclude the canted end of the Cathedral of Milan apse, three-bay long apse-like projections as well. The preceding observations point more strongly toward the Cathedral of Milan as the primary source of inspiration for the Santo Spirito floor plan than the more proximate Cathedral of Pisa, which features a similar extended ambulatory but entirely different numbers and arrangements of bays.[55] While Brunelleschi may have studied the projected design for the Cathedral of Milan, however, like Antonio di Vincenzo before him he appears to have returned home particularly impressed by the interior of the Carmine of Pavia, and well versed in its details.

One of the most memorable features of the securely attributed Basilica of Santo Spirito is the surreally foreshortened vista that greets visitors upon entering either the left or right façade portal (Figure 5-10).[56] On one side of each aisle, the columns appear to touch one another forming an apparently solid yet diaphanous wall. On the other, engaged columns appear closely packed together, separated only by complex moldings resembling rubbery, compressed gaskets. When similarly viewed down either of the aisles, the Carmine of Pavia appears to be virtually a brick version of the Basilica of Santo Spirito (Figure 5-11). In the Carmine, rows of classically proportioned engaged columns appear tightly packed together, separated only by forms resembling rubbery, compressed gaskets. Here, however, the gasket-like forms occur on both sides of each aisle, and consist of clusters of attenuated colonnettes. Perhaps Brunelleschi even took measurements of the Carmine column diameters and intercolumniations, for their dimensions are very similar to those of Santo Spirito (Figures 5-7 and 6-8, dimensional annotations).[57]

Since the visual evidence presented here places Brunelleschi at the end of one of the aisles in the Santa Maria del Carmine nave, carefully studying the striking effect of one-point perspective and quite possibly recording measurements to further his investigation, we might reasonably propose that the Carmine contributed to Brunelleschi's research pertaining to his eventual development of scientific perspective drawing techniques. Indeed, some influence of the Carmine may be detectable in Masaccio's *Trinity* fresco in the basilica of Santa Maria Novella in Florence, a project on which Brunelleschi very likely collaborated.[58] In that fresco, small Doric columns serve as visual gaskets that separate pairs of Ionic columns in the foreground and background (Figure 5-12, middle column). The resultant clusters of three columns visible on each side of the central barrel vault appear tightly packed together in perspectival compression, much like the engaged columns and colonnettes of the Carmine of Pavia, and the engaged columns and complex molding strips of Santo Spirito (Figures 5-10 and 6-11). Perhaps Brunelleschi considered these little intermediate Doric columns in the *Trinity* to be necessary devices for leading the eye into perspectival space, after having first observed a similar effect in three-dimensions at the Carmine.

Another hallmark feature of the Basilica of Santo Spirito that is prefigured in the Carmine is the union of the first step leading into the chapels with the plinths of the engaged columns standing between the chapels (Figure 5-13). Following Saalman, scholars typically attribute this elegant device to Brunelleschi, but we now see that Bernardo used it first in the Carmine (Figure 5-14).[59]

The visual evidence presented above regarding deep nave chapels, nave bay interior elevations, foreshortened aisle views, and plinth/step unions suggests that the Carmine of Pavia exerted a substantial influence on an impressive array of late fourteenth and early fifteenth-century basilicas outside of Pavia, including the Basilicas of San Petronio in Bologna; and Santa Trinita, San Lorenzo and Santo Spirito in Florence. Other possible Carmine-inspired basilicas, recognizable by their modular layouts and signature rows of deep nave chapels, perhaps include two more works of Bernardo da Venezia: the Certosa of Pavia, which according to Ackerman's reconstruction originally was to include deep nave chapels, and the basilica of Santa Maria del Carmine in Milan (founded c. 1400).[60] Later deep nave-chapel basilicas that perhaps belong to this lineage include those of Santa Maria delle Grazie in Milan (begun by Giuniforte Solari in 1463), San Francesco in Ferrara (begun c. 1470), and San Salvatore in Padua (begun c. 1460).[61]

The list of Carmine-influenced basilicas should perhaps also include the Cathedral of Milan which, as noted above, was originally planned with deep nave chapels in place of the outermost side aisles (Figure 5-9). By 1391, after the foundations for at least a portion of these nave chapels had been completed, the chapels were removed from the design. In 1400 Bernardo da Venezia and a collaborator, Bartolino da Novara, petitioned Duke Gian Galeazzo Visconti for their reinstatement.

Although the petition was unsuccessful, it illuminates some contemporary arguments in favor of this innovative and influential chapel scheme. The architects' first argument is iconographical: through this modification, they claim, "[…] se porave vedere el corpo de Cristo [...]," in other words, one would perceive the shape of the cross in the interior void thus created. Their second argument is structural: The deep nave chapels "[…] vegniarevese a dare grandissima forteza ale altre tre nave [i.e., the central nave and two side aisles] per quilli archi butanti avereve più fermo […]," in other words, the chapel walls would serve as buttresses to support the vaulted nave and aisles.[62]

These contemporary observations, combined with the observations presented above, indicate that the remarkable basilica of Santa Maria del Carmine of Pavia appears to have introduced social, spatial, experiential, optical, iconographical, structural and classical ornamental innovations into late fourteenth and early fifteenth century architectural culture. To this list may now perhaps be added a stylistic innovation that may be particularly relevant to our research into the sources of Brunelleschi's early Renaissance style.

<u>Regional Romanesque Revivals</u>

In the Carmine of Pavia Bernardo presents a highly disciplined Lombard Romanesque style that is analogous to Brunelleschi's own unique style, which is essentially Tuscan Romanesque in architectural vocabulary and found its first complete expression half a century later in the design of the Basilica of San Lorenzo in Florence. A seemingly conscious revivalist tendency in the Carmine becomes apparent through comparison with the small Romanesque abbey church of Cerreto in Lodi, which Romanini identifies as its likely model (Figures 5-4 and 5-15).[63] In addition to their floor plans based on cruciform arrangements of eight large square modules—that of the Carmine lined with deep nave chapels, that of Cerreto lacking nave chapels—both churches share Romanesque features such as robust columns with cushion capitals, rudimentary ogival cross-vault ribs, and plain archivolts that are semi-circular at Cerreto, and only slightly pointed in the Carmine.[64]

Of particular note, however, is not merely the reuse of outmoded forms, but the apparent deliberateness with which Bernardo has refined and regularized them, replacing Romanesque improvisation with a rigorous code of classical consistency and rationality. Gone, for example, are the gravity-defying, engaged corbelled columns of the Cerreto nave that taper, contrary to classical norms, from top to bottom, and the ambiguous surfaces to which they are attached that transmogrify from massive piers to delicate colonnettes (Figure 5-15). In their places appear various standardized columns of a distinctly classical character (Figure 5-4). Bernardo even demonstrates an understanding of antique superposition: at Cerreto all column capitals are identical (Figure 5-15); in the Carmine of Pavia the major order has Corinthian-like capitals, in notable contrast to the Doric-like cushion capitals of the minor order (Figure 5-4). Even more remarkable is Bernardo's use of the double-scotia column base, an uncommon feature in Lombardy that implies direct knowledge of ancient Roman works (Figures 5-14 and 5-16).[65]

Just as Bernardo, at the Carmine, rationalized and in some cases quite specifically Romanized the forms of the Lombard Romanesque style, so too did Brunelleschi, at San Lorenzo and Santo Spirito, dispense with the polygonal column shafts, irregular arches, and exuberant polychromy that characterize his apparent Tuscan Romanesque sources such as the exterior arcades of the Baptistery of Florence, in favor of, in the words of Saalman, "reduction and regularization of forms and the absolute uniformity of identical details."[66] For example, he did not merely borrow the entablature blocks of the aforementioned Baptistery arcades (and perhaps those of other works such as the Badia of Fiesole facade) down to the smallest detail, but elevated their status from autonomous elements of surface decoration to integral components of rationalized and comprehensive minor order entablature systems (Figure 5-10).[67] As in the Carmine of Pavia, in the Basilicas of San Lorenzo and Santo Spirito structural members (whether actually structural or merely expressions of structure) are set off by white plaster walls that do not appear to have ever been intended to be frescoed. The overall result is a monumentality and regularity that is distinctly Roman in character, if Romanesque in vocabulary.

Manetti's description of Brunelleschi's particular brand of classicism as "[…] alla romana ed alla antica […]," together with his accounts of Brunelleschi's Roman sojourn, indicate that at least one fifteenth-century observer believed that Brunelleschi was driven by a conscious revivalist impulse, even if the evidence presented above indicates that this impulse was not limited to Roman sources.[68] Would it be correct to interpret Bernardo's classicism at the Carmine of Pavia in a similar revivalist light? Would this Lombard building best be described as an example of a "[…] provincial Gothic ecclesiastical style […]," as does Ackerman in his 1949 article "The Certosa of Pavia and The Renaissance in Milan," or as an early example of what Ackerman later in the same article describes as "[…] the strange phenomenon of the Romanesque revival […]" which he proposes "[…] as the leitmotif of the Milanese Renaissance"?[69] Thus, does Bernardo's classicism constitute Survival or Revival of Romanesque forms?[70] Although we lack commentary from a contemporary Lombard observer comparable to Manetti, the preceding discussion would seem to suggest that both interpretations may be equally valid.

The chief characteristics of the style of the Carmine of Pavia, according to Ackerman, are "first, that this Lombard Gothic has ignored thirteenth and fourteenth century developments elsewhere, and second, that it is none the less truly Gothic, and not a sub-Romanesque vestige."[71] Yet the style of the Carmine would also seem to be consistent with Ackerman's description of the

Milanese Renaissance style that emerged nearly a century later. Driving the adoption of the Lombard Romanesque revival by Milanese patrons and architects in the mid- to late-fifteenth century, Ackerman proposes, were four factors: 1) the intense regionalism of Lombard architects, 2) "[…] the impressive effects of massing and interior space […]" that the Romanesque style provided, 3) the "non-Gothic" character of the Romanesque style, which made it modern in the Renaissance sense, and 4) the belief that the Romanesque style was "[…] the stepping stone to Rome, and as such enjoyed high repute."[72] Indeed, the same four factors might also explain not only the Romanesque features of the Carmine of Pavia, but the Tuscan Romanesque features of Brunelleschi's works in Florence.

Conclusion to the Lombard Connection

If Bernardo da Venezia's Lombard Romanesque-inflected style in the Carmine of Pavia is the product of a conscious revival and refinement of regional Romanesque forms, it would constitute a particularly provocative precedent for our study of Brunelleschi's Tuscan Romanesque-inflected style, for it would raise the question of whether or not Brunelleschi understood the style of the Carmine to be a conscious Romanesque revival. If he did, it would raise the additional question of whether Brunelleschi borrowed this revivalist impulse from the Carmine, as he appears to have borrowed other ideas; or conversely, whether his own Tuscan Romanesque revival constituted a similar yet independent development half a century later. Scholars have identified other examples of Romanesque revivals in northern Europe from the late fourteenth to the early sixteenth centuries, but those of Bernardo and Brunelleschi are distinguished by their highly disciplined, Romanizing classicism.[73]

This comparison between Bernardo's and Brunelleschi's revivalist styles is, of course, a limited one due to the obvious differences of appearance between them. While each may be interpreted as a "stepping stone to Rome", due to its refinements of its respective regional Romanesque style forms, Brunelleschi's appears, at least outwardly, to lead more directly to Rome than Bernardo's. Not only does the Tuscan Romanesque style look more Roman than the Lombard Romanesque, but Brunelleschi's use of monochromatic *pietra serena* for all structural articulations imbues his buildings with a marble-like austerity that reinforces the Roman resemblance (Figures 5-10 and 5-11).[74] These characteristics made Brunelleschi's style an effective conduit to the revival of the supra-regional architecture of ancient Rome initiated by the next generation of architects, including Giuliano da Sangallo, Alberti, and Bramante—a revival that may be considered the essential characteristic of Renaissance architecture.

Whether or not Bernardo da Venezia's revivalist impulse helped to inspire Brunelleschi's similar impulse—and thus indirectly influenced the development of the Renaissance style of subsequent generations—is too complex a question to be answered given the current state of knowledge about late medieval Lombard architecture and its fifteenth century dissemination. As for the particular characteristics of Brunelleschi's style itself, however, a decisive Lombard influence seems undeniable in light of the evidence presented in this study. Previous scholars have viewed Lombardy as the *recipient* of early Renaissance architectural influence from Florence, through the work of Filarete and others beginning in the mid-fifteenth century. We now see that the influence appears to have been mutual, and to have begun when Brunelleschi, and probably Dolfini before him, looked to Lombardy as a source of architectural design innovation.

In addition to the apparent Lombard influences considered here, the design of the basilica of San Lorenzo also exhibits influences of medieval buildings in Florence. Brunelleschi, for example, appears to have drawn inspiration from the blind arcades of the Baptistery of Florence in his design of the San Lorenzo nave arcade bays. Furthermore,whoever designed the set of proportions embedded in the dimensions of the latter—i.e., Dolfini or Brunelleschi; in Chapters 2 and 4 I have argued that it was more likely Dolfini—appears to have drawn proportional raw materials from the nave arcade bays of the basilica of Santa Maria del Fiore (the Cathedral of Florence) with which to begin.

<u>5.2 Santa Maria del Fiore</u>

In Chapter 2, I identified a subtle and complex set of proportions in the San Lorenzo nave arcade bays that contains distinct layers of significance related to late medieval geometry, number theory and arithmetic.[75] That study reveals features never before metrically documented in the study of medieval or Renaissance architectural proportion, including key dimensions determined plinth to plinth, the use of fractions as both numerical and graphic devices, and the use of number pairs (both whole and fractional) to closely approximate geometrically-derived, mathematically irrational ratios (Figure 4-12). Scholars typically single out the proportions of the Basilica of San Lorenzo as marking a turning point in the history of architecture—a "radical departure," according to one popular textbook, from medieval precedent.[76] It is a claim, however, based on *prima facie* impressions, for prior to my study no one knew what the proportions of that basilica are because no one had ever studied them based on accurate, comprehensive and verifiable measurements.[77] Ultimately the claim is an attempt to attribute a perceived difference in overall visual character between medieval and Renaissance architecture to systematic, orderly and mathematically rational sets of proportions; sets that are purportedly present in Renaissance architecture (of which San

Lorenzo is taken as an archetypal example) but not medieval.[78] My recent study constitutes one step toward correcting this misconception, for it shows that every aspect of the set of proportions found in the basilica of San Lorenzo is thoroughly consistent with late medieval knowledge and practice. My attribution of that set of proportions to Matteo Dolfini constitutes another step, for Dolfini, the prior-architect who preceded Brunelleschi as *capomaestro* of the basilica reconstruction and who lived most of his life during the fourteenth century, can hardly be considered a Renaissance figure.[79] A third step is now to identify similarities between that set of proportions and those of medieval buildings.

One particularly prominent medieval structure that has a set of proportions that bears notable similarities to the San Lorenzo nave arcade bay set of proportions is the nave of the basilica of Santa Maria del Fiore. The similarities in these sets of proportions suggest not only that the former is most productively studied in a medieval context, but that Dolfini may have borrowed specific parts of the Santa Maria del Fiore set of proportions for use in the design process that ultimately led him to the San Lorenzo set of proportions. The nave arcades of the Basilica of Santa Maria del Fiore make promising subjects for a study of architectural proportion because they are composed of repeated bays with logical subdivisions (Figure 5-17), and because surviving documents record discussions within the cathedral *Opera* about the design and dimensions of those bays.[80]

We may assume that every detail of this prominent, publicly-financed construction project was closely studied by all architects and aspiring architects of note in late fourteenth-century Florence, including Dolfini. Thus, a study of the Santa Maria del Fiore proportions is likely to yield valuable insights into architectural practices that were current when Dolfini designed the San Lorenzo set of proportions. This study is in two parts: Part I describes what appears to be the set of proportions, or a part thereof, that architect Francesco Talenti designed for the Santa Maria del Fiore nave arcades, with the approval of the cathedral *Opera*. Part II explores the mathematical knowledge and attitudes toward quantification in fourteenth-century Florence that constitute necessary historical context for a correct reading of that set of proportions.

A Proposed Nave Arcade Bay Set of Proportions

The four-bay nave of the Basilica of Santa Maria del Fiore is defined by eight large, slightly pointed arches supported by piers that appear to be evenly spaced (Figures 5-17 and 5-18).[81] Indeed Bernardo Sansone Sgrilli, in his detailed floor plan and cross-section of the basilica published in 1733, seems to show the nave arcade piers evenly spaced. Rocchi et al. appear to do the same in their larger and more detailed floor plans of 1988.[82] Gustavo Uzielli's dubious claim that in 1896 he recorded several measurements between the nave piers and found that the average corresponded exactly to the nave bay widths specified in a document of 1357 (discussed below) demonstrates that he, too, assumed that all the bays were of equal width.[83] My measurements reveal a more complex situation.[84] The widths of the nave arcade bays vary by as much as 1.2 br (70.5 cm) from one to the next, and those width irregularities are not randomly distributed, but occur in approximately corresponding pairs down the length of the nave.[85] The westernmost bay in each nave arcade (adjacent to the interior façade) each measures nearly exactly 29 br plinth to plinth. The next bay to the east in each arcade measures approximately 29 $\frac{1}{10}$ br; the next, between 28 $\frac{1}{2}$ br and 28 $\frac{1}{3}$ br; and the last, about 28 br (Figure 5-18). These variations would be too large to permit proportional analysis of the individual nave arcade bays were it not for a surviving document that specifies the originally-intended bay dimensions.

Records of the cathedral *Opera* indicate that the design of the nave arcades received careful review by an expert committee for nearly two years before being finalized. On 26 June 1355, the committee decided that a model of the basilica then being made by Talenti was too expensive, and thus should be built "[…] only as far as two columns and the vaults of the arches […]."[86] Evidently the committee expected all the nave bays to be identical, and believed that a model of just one nave bay would suffice. A few weeks later, another committee examined "[…] the models of the columns and the measurements."[87] On 17 June 1357, the floor plan dimensions were formally established as follows:

> And that it is intended that the space from middle of column to middle of column be 33 $\frac{3}{8}$ $\frac{1}{1}$ *braccia* for the width [of the nave]. And for the length, 34 br. From which [are to] follow three vaults [i.e., vaulted bays], one after the other, from middle of column to middle of column, in width thirty-three and three-eighths and a half *braccia*; [and] in length, 34 *braccia*, from middle of column to middle of column.[88]

Let us first examine the 1357 east-west bay width specification (called "length" in the preceding quotation, but nowhere else in this study). Since according to my survey most of the nave pier footprints measure nearly exactly 5 br (291.8 cm) wide, the specified bay width of 34 br (1984.24 cm) on center equals 29 br (1692.44 cm) plinth to plinth (Figures 5-18 and 5-19).[89] As noted above, this measurement was in fact executed only in the westernmost bay of the nave (Figure 5-18).[90] Since the nave was built from west to east, this combination of metrical and documentary evidence suggests that only the first bay was built precisely to specification. Less than a decade later, the second bay was stretched slightly and the third bay was compressed, for a total loss of about $\frac{1}{2}$ br from the combined widths of all three originally-specified nave bays. A fourth bay was added to the design of the basilica on 13 July 1366, and committed to stone in 1377. According to my measurements, this bay was reduced by about a full *braccio* from the originally-specified bay width (Figure 5-18).[91]

The reasons for the increase and subsequent decrease in the widths of the second through fourth bays of the nave (counting from west to east), after the first bay correctly established the width specified in 1357, are unknown. Perhaps, following Arnolfo di Cambio's late thirteenth-century beginnings, the fourteenth-century construction effort that proceeded from the west had to accomodate some preexisting work laid by Arnolfo.[92] Alternatively, the variations perhaps represent the common medieval practice of incorporating architectural refinements into large buildings for the purpose of adding visual richness.[93] Whatever the reasons for the dimensional variations in the nave bay widths, the preceding analysis indicates that the first (westernmost) bay contains the width that Talenti originally intended for all the bays. Let us examine that width in more detail.

The committee charged by the *Opera* with approving the dimensions of the nave arcade bays may have found on center measurements to be expedient when describing key width dimensions in a document, but Talenti appears to have determined the proportions of his nave arcade bays by measuring plinth to plinth. Had all the nave arcade bays been built with a plinth to plinth distance of 29 br as Talenti apparently intended (and not merely the westernmost bay in each arcade), then because of the 5 br pier plinths, the distance between the *farther edges* of the two plinths in each bay would be 39 br (Figure 5-19).

A square-and-a-half inscribed horizontally between two plinths spaced as such has a height of $19\frac{1}{3}$ br. A two-square rectangle drawn horizontally to touch the *farther edges* of those plinths has a height of $19\frac{1}{2}$ br. These two geometrical figures *nearly* overlap along their top edges, with a discrepancy of $\frac{1}{6}$ br (9.75 cm), or, 0.86% (Figure 5-19). Apparently this near-overlap was close enough for Talenti and the *Opera*'s conception of geometrical correspondence. The pier shafts, which vary in height (measured to the bottoms of the astragals) by just a few centimeters from one to the next, have a mean height of 1133.69 cm, or, just 0.53 cm taller than $19\frac{5}{12}$ br.[94] This height falls exactly midway between $19\frac{1}{3}$ br and $19\frac{1}{2}$ br. Thus, by splitting the difference between the heights of the two rectangles in question Talenti gave equal importance to both, and thereby effectively ignored the geometrical height discrepancy. Talenti appears to have been equally willing to ignore numerical discrepancies for the sake of finding proportional order.

The width and height dimensions of both the aforementioned square-and-a-half and double square, arranged in size order, are:

$$19\frac{1}{3},\ 19\frac{1}{2},\ 29,\ 39$$

In the San Lorenzo nave arcade bay set of proportions, I have shown that the fractional endings of $\frac{2}{3}$ attached to several key dimensions serve as graphic flags indicating that those dimensions must be grouped together before the numerical significance of the set of proportions can be read. Then, to reveal that significance, the fractions must be ignored (Figure 4-12).[95] In the set of proportions designed by sets of proportions for the Santa Maria del Fiore nave arcade bays, by contrast, it seems that the fractions must be ignored right away. Removing them, and the resultant duplicate whole number, produces the progression:

$$19,\ 29,\ 39$$

Thus we have a number progression that increases by increments of 10, always leaving 9 as the last digit. Nine (9), as the square of 3, symbolizes the Trinity, and is thus consistent with the Trinitarian symbolism implied by the original 3 nave bays and 3 tribunes in the basilica floor plan before the fourth nave bay was added. Perhaps also significant to Talenti was the correspondence between the sum of the three numbers in the above progression and the sum of the original three bay widths, measured plinth to plinth; thus: 19 + 29 + 39 = 87, and 29 + 29 + 29 = 87.

We have now examined the width-to-height proportions of only the lower order in the Santa Maria del Fiore nave arcades, measured to the tops of the pier shafts. There are two levels of column-like nave piers, however, one stacked atop the other (Figures 5-17 and 5-19). The heights from the floor to the tops of the upper pier shafts (again marked by the bottoms of the astragals) vary by just a few centimeters from one pier to the next, and closely converge around the dimension 41 br.[96] Considered together as a pair, the height of 41 br and the plinth to plinth distance of 29 br produce an extremely accurate approximation of the ratio 1:√2.[97] This pair thus effectively describes a root-2 rectangle, inscribed between adjacent pier plinths, that rises to the tops of the upper pier shafts within discrepancies of no more than 7 cm, or just 0.3% (Figures 5-20 and 5-21).[98]

Possible San Lorenzo Seed Numbers

The appearance of the width-to-height ratio 29:41 in the Santa Maria del Fiore nave arcade bays is striking because the same ratio appears in the San Lorenzo nave arcade bays, in the form $9\frac{2}{3}:13\frac{2}{3}$. The latter can be converted to 29:41, and vice versa, through simple fractional arithmetic that was well within the capabilities of educated Florentines by the late fourteenth century (Figures 4-12, 5-17 and 5-20).[99] The ratio 29:41, in turn, can be derived from a simple formula that generates an infinite progression of whole number approximations of the ratio $1:\sqrt{2}$. This formula is described in a treatise on arithmetic written by Theon of Smyrna in the first century, A.D., which could possibly have been available in Florentine learned circles by the late fourteenth century.[100] Thus, while Dolfini (or Brunelleschi, if one prefers) could possibly have learned of the ratio 29:41 through an intellectual environment that had absorbed the lessons of Theon's treatise, another possibility, which does not preclude the first, is that he learned it directly from the Basilica of Santa Maria del Fiore.

The similarities between the nave arcade bay sets of proportions found in the basilicas of Santa Maria del Fiore and San Lorenzo go beyond the use of the ratio 29:41 and its alternate form, $9\frac{2}{3}:13\frac{2}{3}$. Also similar is the way in which this ratio is used. In both sets of proportions this ratio describes the dimensions, in *braccia*, of a root-2 rectangle that is part of a framework of three overlapping (or in the case of Santa Maria del Fiore, nearly overlapping) geometrical figures, all of which are based on the square and its diagonal. In both sets of proportions that framework touches the nearer and farther edges of the two column or pier plinths in each bay, and (exactly or nearly) the tops of the column shafts measured to the bottoms of the astragals (Figures 4-12, 5-19 and 5-20).[101] In both, furthermore, the numbers that describe the widths and heights of all of these overlapping geometrical figures do double duty as both dimensional specifications and bearers of non-quantitative meaning. Regarding the latter, both employ fractions in supportive roles that require that the fractions be ignored at appropriate moments, such that the whole numbers to which they are attached can be read as components of number progressions that denote abstract meanings ultimately related to the medieval concept of *ordine* (lit. "order").[102]

In light of these similarities, we may reasonably hypothesize that Dolfini began his design of the San Lorenzo nave arcade bay set of proportions by reducing the key dimensions of the Santa

Maria del Fiore set of proportions by two-thirds. In order to explore this hypothesis, let us first review the key dimensions of the San Lorenzo nave arcade bay set of proportions, which are (refer to Figure 4-12):

$$1\frac{2}{3}\text{ br},\ \ (5\frac{2}{3}\text{ br},)\ \ 9\frac{2}{3}\text{ br},\ \ 13\frac{2}{3}\text{ br},\ \text{ and }\ 17\frac{2}{3}\text{ br}.$$

Other important San Lorenzo nave arcade dimensions include:

$$1\frac{1}{2}\text{ br, 2 br, and }2\frac{1}{3}\text{ br.}$$

Returning now to Santa Maria del Fiore and dividing all the key dimensions by 3 using simple fractional arithmetic (as noted above) produces the following dimensions (refer to Figures 5-19 and 5-20): the plinth width reduces from 5 br to $1\frac{2}{3}$ br; the plinth to plinth distance, from 29 br to $9\frac{2}{3}$ br; the distance between the farther edges of the pier plinths, from 39 br to 13 br; the lower pier shaft height, from $19\frac{5}{12}$ br to $6\frac{17}{36}$ br; and the upper pier shaft height, from 41 br to $13\frac{2}{3}$ br. Thus, the newly scaled-down dimensions from the Santa Maria del Fiore nave arcade bays, arranged in size order, are:

$$1\frac{2}{3},\ 6\frac{17}{36},\ 9\frac{2}{3},\ 13,\ 13\frac{2}{3}$$

Three of these numbers, $1\frac{2}{3}$, $9\frac{2}{3}$, and $13\frac{2}{3}$, which no longer need be associated with their original locations in the Santa Maria del Fiore nave arcade bay set of proportions, perhaps served as numerical seeds of the San Lorenzo nave arcade bay set of proportions. From them Dolfini perhaps began to visualize the major elements of that future set of proportions, including the accurate numerical approximation of the proportions of the root-2 rectangle, the use of those numbers in a Boethian number progression, and the use of common repeated fractions to call out those numbers as a group (Figures 4-12). Another important dimension in the Santa Maria del Fiore nave that might have helped Dolfini along in this direction is the height from the floor to the top of the upper gallery (*ballatoio*) railing. Although it does not appear to be incorporated into the Santa Maria del Fiore set of proportions, this height (A in Figure 5-19) varies from about 51 br to 51 $\frac{2}{3}$ br (Figure 5-21). Dividing this varying height by 3 produces dimensions that range from about 17 br to 17 $\frac{1}{5}$ br. This reduction thus adds the number 17 (albeit without the fraction $\frac{2}{3}$) to the array of seed numbers that Dolfini perhaps derived from the Santa Maria del Fiore nave arcades for eventual incorporation into the San Lorenzo nave arcade bay set of proportions (Figure 4-12). Let us recall, furthermore, that since Brunelleschi appears to have based the Santo Spirito arcade bay set of proportions on the nave arcade bay set of proportions of San Lorenzo, any seed numbers that may have influenced Dolfini in his development of the San Lorenzo set of proportions must necessarily also be considered seed numbers for the Santo Spirito set of proportions.

The Santa Maria del Fiore nave arcades could have provided yet one more seed number for Dolfini, this one hidden underground. The aforementioned document of 19 June 1357 specifies "that the foundation of each column from the space [of the nave] down is to be made 7 br per side, square, down to good gravel in water."[103] Note that 7 br divided by 3 equals 2 $\frac{1}{3}$ br, the likely intended height of both the San Lorenzo and Santo Spirito entablature blocks (Figures 2-50 and 4-12).[104] I have previously noted that this dimension, in combination with the San Lorenzo and Santo Spirito capital height of 1 $\frac{2}{3}$ br, produces the ratio 1 $\frac{2}{3}$: 2 $\frac{1}{3}$ (Figure 4-12), which is equivalent to 5:7; a ratio that constitutes another whole number approximation of the ratio 1:√2 that can be derived from Theon of Smyrna's formula.[105] In the Basilica of Santa Maria del Fiore the same ratio is generated from the 7 br square nave pier foundation noted in the document of 1357, in combination with the essentially 5 br square plinths that they support (Figure 5-18). The use of the ratio 1:√2, or its close approximation, to determine the thicknesses of foundations relative to the columns or walls that they support may have been common practice during the medieval and Renaissance periods. Sebastiano Serlio, for example, citing Vitruvius, notes that relative thicknesses of temple walls and their foundations should be the same as the relative widths of two consecutive squares in a rotation of squares series, or, 1:√2.[106]

Imprecision in Sets of Proportions

However striking the above-noted similarities between the San Lorenzo and Santa Maria del Fiore nave arcade bay sets of proportions may be, one significant difference between them remains: while the San Lorenzo set of proportions embodies remarkable geometrical and mathematical precision, the Santa Maria del Fiore set of proportions embodies remarkable *imprecision.*[107] Most notably, the overlapping square-and-a-half and double square, based on the plinth to plinth dimensions of 29 br and 39 br, respectively, fail to perfectly overlap along their top edges (Figure 5-19). This imprecision cannot be attributed to construction error, as I have argued is the case with a comparably-sized imprecision in the San Lorenzo nave arcade proportions, because here the problem is geometrical—these particular rectangles, with the base dimensions of 29 br and 39 br, simply do not fit together perfectly.[108] Furthermore, in the Santa Maria del Fiore set of proportions as described above, in order to access the whole-number progression 19, 29, 39, fractions must be removed from occurrences of the first number (in the forms of $19\frac{1}{3}$ br and $19\frac{1}{2}$ br) but not the others. This inconsistency contrasts markedly with the San Lorenzo set of proportions, in which all the components of a number progression that Dolfini apparently wanted to call attention to bear the common fractional ending $\frac{2}{3}$.

There would seem to be but two possible explanations for the presence of these instances of imprecision in the Santa Maria del Fiore set of proportions: either my hypothesis is incorrect, and the set of proportions described above is in fact not intentional but merely a series of imperfect geometrical and numerical coincidences; or Talenti had a greater tolerance for proportional imprecision than Dolfini did by the time Dolfini designed the San Lorenzo nave arcade bay set of proportions. The first possibility cannot be discounted. My hypothesis accounts for the broad outlines of the Santa Maria del Fiore nave arcade bay proportions, tied to many of the same points of measurement as is the San Lorenzo nave arcade bay set of proportions, but it does not account for several important dimensions such as the heights of the capitals, entablature block strips, and both the top and bottom of the *ballatoio*. There may yet be additional parts of the set of proportions that I have described above, or another nave arcade bay set of proportions altogether, awaiting discovery that will provide a more complete explanation for all the key dimensions of the nave arcades; though if there is one I have not found any evidence of it.

Nevertheless, in light of these uncertainties, I present the results of the preceding analysis as a working hypothesis—a designation that makes it no less productive a vehicle for exploring the principles of medieval architectural proportion than a more secure hypothesis would be. If we assume, for the remainder of this study, that the Santa Maria del Fiore nave arcade bay set of proportions described above was indeed intentionally designed by Talenti, then we need to explain how an architect capable of addressing all the technical demands inherent in the design of a major cathedral could have tolerated the geometrical and numerical imprecision that this set of proportions embodies. To do so, we need to explore the history of medieval arithmetic as a reflection of medieval attitudes about quantification.

I thank James S. Ackerman, Howard Burns and Caroline van Eck for their comments on the manuscript for this chapter. Research in Italy was made possible by a 2005 Washington State University New Faculty Seed Grant from the WSU Foundation and the Office of the Vice Provost for Research. An earlier version of this article was presented at the conference "Die Basilika: Ein herausragender Bautypus der europäischen Architekturgeschichte," Stiftung Bibliothek Werner Oechslin, Einsiedeln, Switzerland, 20-23 September 2007.

[1] "[…] the sacristy went forward before every other thing and advanced to a state that aroused the marvel of everyone in the city, and of the visitors who chanced to see it, because of its new and beautiful style. The many people constantly gathering there caused great annoyance to those working there." Antonio Manetti, *Vita di Filippo Brunelleschi*, Giuliano Tanturli, ed., Milan 1976, p. 109.

[2] Antonio di Tuccio Manetti, who who died in 1497 and probably composed the *Vita di Filippo Brunelleschi* in the 1480s, did not likely witness the completion of the Old Sacristy. Nevertheless, at the time of his writing it was an event from the recent history of the city, and he could conceivably have spoken with others who did witness it. On the date of the *Vita* see Antonio di Tuccio Manetti, *The Life of Brunelleschi*, Howard Saalman, ed., University Park and London 1970, "Introduction," p. 10.

[3] Matthew A. Cohen, "How Much Brunelleschi? A Late Medieval Proportional System in the Basilica of San Lorenzo in Florence," *Journal of the Society of Architectural Historians*, LXVII, 1, 2008, p. 18 and note 2; and Rudolf Wittkower, "Brunelleschi and 'Proportion in Perspective'", *Journal of the Warburg and Courtauld Institutes*, XVI, 3-4, 1953, pp. 275-291.

[4] Cohen, Ivi, pp. 41-43.

[5] Ivi, pp. 18-57.

[6] Sets of proportions consist of geometrical, numerical and arithmetical relationships that can be comprehended only mentally, not visually. Modern observers who attribute architectural beauty and value to set of proportions (whether rigorously documented or imagined) perpetuate a mystical belief system that traces back through the Romantic period to the medieval and Renaissance periods.

[7] Giorgio Vasari, *Le Vite de' piú eccellenti architetti, pittori, et scultori italiani da Cimabue insino a' tempi nostril: Nell'edizione per I tipi di Lorenzo Torrentino, Firenze 1550*, ed. by Luciano Bellosi and Aldo Rossi, Torino 1986, p. 283: "… solo l'intento suo era l'architettura, che già era spenta, dico gli ordini antichi buoni e non la todesca e Barbara, quale molto si usava nel sup tempo". Manetti, *Vita*, cit, [cfr. note 1], pp. 48: "[...] si rinnovò questo modo de' muramenti che si dicono alla romana ed alla antica, a che molto vanamente si va oggi tanto dietro; e chi di nuovo l'arecò a luce; ché prima

erano tutti tedeschi [...]", 55, 64-70, 76. Other early promoters of this view include Filarete and Giovanni Rucellai. Howard Burns, "Quattrocento Architecture and the Antique: Some Problems", in R.R. Bolgar (ed.), *Classical Influences on European Culture A.D. 500-1500: Proceedings of an International Conference Held at King's College, Cambridge, April 1969*, Cambridge 1971, p. 277 note 3. Francesco Paolo Fiore, "Introduzione", *Storia dell'architettura italiana: Il quattrocento*, Francesco Paolo Fiore (ed.), Milan 2007, II ed., p. 9. Ernst H. Gombrich, "From Revival of Letters to the Reform of the Arts: Niccolò Niccoli and Filippo Brunelleschi", Douglas Fraser, Howard Hibbard, Milton J. Lewine (editors), *Essays in the History of Art Presented to Rudolf Wittkower*, London 1967, p. 79. For two early survey text references to Brunelleschi as the reviver of ancient Roman architecture, see Banister Fletcher, *A History of Architecture on the Comparative* Method, XVI ed., New York 1958, pp. 624, 629, and earlier editions; and William Henry Goodyear, *Renaissance and Modern Art,* London 1900, p. 73. See also John Onians, *Bearers of Meaning: The Classical Orders in Antiquity, the Middle Ages, and the Renaissance*, Princeton 1988, p. 130; Howard Saalman, "Filippo Brunelleschi: Capital Studies", *The Art Bulletin* XL, 2, 1958, pp. 114-115; and Marvin Trachtenberg, "Gothic/Italian 'Gothic': Toward a Redefinition," *Journal of the Society of Architectural Historians*, L, 1, 1991, pp. 22-23.

[8] "[…] their musical proportions […]." Manetti, *Vita*, cit. [cfr. note 1], p. 66. Whether or not it is accurate, this comment may represent an attempt on Manetti's part to associate Brunelleschi with the avant-garde architectural theories of Alberti, whose *De re aedificatoria* was published around the time Manetti composed the *Vita*, and which contains a detailed discussion of musical proportions. Leon Battista Alberti, *De re aedificatoria*, Florence 1486, IX, 10.

[9] Carl von Stegmann and Heinrich von Geymüller, *Die Architektur der Renaissance in Toskana*, Munich 1885, I, p. 18. For the term "metrical coherence", and variations thereof in relation to the work of Brunelleschi, see Wittkower, "Brunelleschi and 'Proportion in Perspective'", cit. [cfr. note 3], pp. 132-133, 275-291.

[10] Vasari does not only associate Brunelleschi's style with ancient Roman architecture [cfr. note 7], but also with a prominent example of the Tuscan Romanesque style in Florence, the Basilica of Ss. Apostoli: "In Fiorenza poi migliorando alquanto l'architettura, la chiesa di Sant'Apostolo, che fu edificata da Carlo Magno, fu, ancor che piccolo, di bellissima maniera…. In somna, l'architettura di questa chiesa e tale, che Pippo di ser Brunellesco non si sdegnò di servirsene per modello nel fare la chiesa di Santo Spirito et quella di San Lorenzo nella medesima città." Giorgio Vasari, *Le vite de' piu eccellenti pittori scultori e architettori*, Karl Frey (ed.), Munich 1911, I, p. 195. Building upon this comment by Vasari, Dehio notes that the correspondences between the Basilicas of Ss. Apostoli,

San Lorenzo, and Santo Spirito are precise enough to preclude any inspiration from Rome on the part of Brunelleschi. Georg Dehio, “Romanische Renaissance”, *Jahrbuch der königlich preussischen Kunstsammlungen*, 7, 1886, p. 129. Saalman believes that Dehio’s Brunelleschi/Tuscan Protorenaissance connection is “somewhat overemphasized”, since Saalman observes notable differences between the capitals of Brunelleschi and their Tuscan Romanesque predecessors. Saalman, “Filippo Brunelleschi: Capital Studies Capital Studies”, cit. [cfr. note 7], p. 115.

[11] “…in Rome, from the classical exemplars, but rather in Florence and elsewhere from medieval works of Romanesque character…”. Paolo Fontana, “Il Brunelleschi”, *Atti del X congress internazionale di storia dell’arte in Roma*, Rome 1922, p. 177. Cf. Id., “Il Brunelleschi e l’architettura classica”, *Archivio storico dell’arte*, VI, 1893, pp. 256-267.

[12] On Hoffman and Horster see discussion and references in Trachtenberg, “Brunelleschi, ‘Giotto’ and Rome”, cit. [cfr. note 12], p. 677. Heinrich Klotz, *Filippo Brunelleschi: The Early Works and the Medieval Tradition*, London 1990. Uta Schedler, *Sythese con Antike und Mittelalter in der Renaissance*, Petersberg 2004, pp. 11-15. Burns, “Quattrocento Architecture and the Antique”, cit. [cfr. note 7], pp. 271-275, 281. Peter Murray, *Architecture of the Italian Renaissance*, New York 1963, pp. 10-15, 33-34. Arnaldo Bruschi, “Religious Architecture in Renaissance Italy from Brunelleschi to Michelangelo,” in Henry A. Millon and Vittorio Magnago Lampugnani (eds.), *The Renaissance from Brunelleschi to Michelangelo: The Representation of Architecture*, New York 1994, p. 125. Marvin Trachtenberg, “Brunelleschi, ‘Giotto’ and Rome”, cit. [cfr. note 12], pp. 677-680. Isabelle Hyman, “The Venice Connection: Questions About Brunelleschi and the East”, Sergio Bertelli, Nicolai Rubinstein, and Craig Hugh Smyth (eds.), *Florence and Venice: Comparisons and Relations*, Florence 1978, I, p. 194 and references therein. *Filippo Brunelleschi: La sua opera e il suo tempo*, I-II, Florence 1980, contributions by Arnaldo Bruschi et. al., Cesare Calano, and Volker Hoffman, II, pp. 389-458. John Onians, “Brunelleschi: Humanist or Nationalist?”, *Art History*, V, 3, 1982, pp. 259-271. Onians, *Bearers of Meaning*, cit. [cfr. note 7], pp. 130-146. Arnaldo Bruschi, *Filippo Brunelleschi*, Milan 2006, pp. 53-175.

[13] Burns, “Quattrocento Architecture and the Antique…”, cit. [cfr. note 7], pp. 277-283. Klotz, *Filippo Brunelleschi: The Early Works*…, cit. [cfr. note 12], pp. 133-139.

[14] Hyman, “The Venice Connection…”, cit. [cfr. note 12], pp. 193-208, and Fabriczy as cited therein, note 1.

[15] Marvin Trachtenberg, “On Brunelleschi’s Old Sacristy as Model for Early Renaissance Church Architecture”, in Jean Guillaume (ed.), *L’Église dans l’architecture de la Renaissance*, Paris 1995, pp. 16-22.

[16] Piero Sanpaolesi, "La Cupola di Santa Maria del Fiore ed il Mausoleo di Soltanieh", *Mitteilungen des Kunsthistorischen Institutes in Florenz* XVI, 3, 1972, pp. 221-260.

[17] Hyman, "The Venice Connection…", cit. [cfr. note 12], p. 206. Irving Lavin, "Donatello's Bronze Pulpits in San Lorenzo and the Early Christian Revival", in *Past-Present: Essays on Historicism in Art from Donatello to Picasso*, Berkeley 1993, pp. 1-27. According to Trachtenberg, of interest to Brunelleschi were not only the Early Christian basilicas of Rome and the later medieval recreations thereof, but also antique buildings later consecrated as churches, notably including the Pantheon, rededicated as Santa Maria Rotunda. Marvin Trachtenberg, "On Brunelleschi's Choice: Speculations on Medieval Rome and the Origins of Renaissance Architecture", in Cecil L. Striker (ed.), *Architectural Studies in Memory of Richard Krautheimer*, Mainz 1996, pp. 169-173.

[18] Onians, *Bearers of Meaning*, cit. [cfr. note 7], p. 130. Trachtenberg, "Brunelleschi, 'Giotto' and Rome", cit. [cfr. note 12], p. 675, and references therein.

[19] Richard Cocke, "Masaccio and the Spinario, Piero and the Pothos: Observations on the Reception of the Antique in Renaissance Painting", *Zeitschrift für Kunstgeschichte*, XLIII, 1, 1980, pp. 21-32.

[20] Leonardo Benevolo, Stefano Chieffi, and Giulio Mezzetti, "Indagine sul S. Spirito di Brunelleschi", *Quaderni dell'istituto di storia dell'architettura*, XV, 85-90, 1968, pp. 34-49. Francesco Quinterio, "Il cantiere della chiesa: il vestibolo e la sagrestia", in Cristina Acidini Luchinat (ed.), *La chiesa e il convent di Santo Spirito a Firenze*, Florence 1996, pp. 91-99.

[21] Vasari, *Le vite*, cit. [cfr. note 7], p. 285.

[22] Manetti, *Vita*, cit. [cfr. note 1], p. 77-80.

[23] Vasari, *Le vite*, cit. [cfr. note 7], p. 285.

[24] Eugenio Battisti, *Filippo Brunelleschi: The Complete Work*, New York 1981, p. 334.

[25] Trachtenberg, "Brunelleschi, 'Giotto' and Rome", cit. [cfr. note 12], p. 681.

[26] Burns furthermore notes: "[…] it is much more likely than not that Brunelleschi went to Rome and studied its monuments on one or more occasions". Burns, "Quattrocento Architecture…", cit. [cfr. note 7], pp. 277, 283, 286.

[27] In addition to his early travels Brunelleschi, according to Manetti, continued to travel later in his life as well, at the frequent invitation of diverse municipalities. Manetti, *Vita*, cit. [cfr. note 1], p. 99.

[28] Marvin Trachtenberg, "Brunelleschi, 'Giotto' and Rome", cit. [cfr. note 12], p. 675.

[29] Frank D. Prager and Gustina Scaglia, *Brunelleschi: Studies of his technology and Inventions*, Cambridge, Massachusetts and London 1970, pp. 2-18.

[30] This quotation is in reference to a convocation conceived, according to Manetti, by Brunelleschi in 1419 with regard to construction of the cupola. Manetti, *Vita*, cit. [cfr. note 1], p. 79.

[31] James S. Ackerman, "'Ars Sine Scientia Nihil Est': Gothic Theory of Architecture at the Cathedral of Milan", *Art Bulletin* XXXI, 2, June 1949, 84-111. Luciano Bellosi, et al, *La Basilica di San Petronio in Bologna*, Milan 1983. Mario Fanti and Deanna Lenzi (eds.), *Una basilica per una città: sei secoli in San Petronio*, Bologna 1994. Richard J. Tuttle, "The Basilica of S. Petronio in Bologna", in Millon and Magnago Lampugnani, *The Renaissance…*", cit. [cfr. note 12], pp. 522-527, cf. 429-430. Richard J. Tuttle, "Bologna", in Francesco Paolo Fiore, *Storia dell'architettura italiana: il quattrocento*, II ed., Milan 2007, pp. 256-259.

[32] In 1404 Brunelleschi served on a board of nineteen advisers to the *Opera* of the Cathedral of Florence that voted to require partial reconstruction of a buttress newly completed by the then *capomaestro*, Giovanni d'Ambrogio. Prager and Scaglia, *Brunelleschi…*, cit. [cfr. note 29], pp. 15-16. Vasari notes that Brunelleschi advised the master masons of the Cathedral of Milan during one of his trips to that city. Vasari, *Le Vite*, cit. [cfr. note 7], p. 302. According to Battisti, Brunelleschi was mentioned in an undated, now destroyed fifteenth-century list of architects active at the Cathedral of Milan. Gaetano Franchetti, *Storia e descrizione del duomo di Milano*, Milan 1908, p. 21 as cited in Battisti, *Filippo Brunelleschi...*, cit. [cfr. note 24], p. 374 n. 8. The reference does not appear in the 1821 edition of Franchetti's *Storia*, however, and I have been unable to locate a copy of the above-cited 1908 edition.

[33] Fabio Benedettucci (ed.), *Il libro di Antonio Billi*, Rome 1991, p. 34. Cohen, "How Much Brunelleschi?...", cit. [cfr. note 3], p. 53 note 58.

[34] "[…] 8 Lombards […]." Manetti, *Vita*, cit. [cfr. note 1], pp. 96-97.

[35] Note that Giuliano da Sangallo often made his own editorial modifications to known buildings in his sketches. While the deep nave chapels he shows in the sketch in question are consistent with other historical evidence, there is no reason to believe that the portico, numerous domical vaults, or second sacristy that he also depicts conform to Brunelleschi's intentions.

[36] Cohen, "How Much Brunelleschi?...", cit. [cfr. note 2], pp. 37-44.

[37] "[...] unwilling, because it seemed to him a miserable thing […]". Manetti, *Vita*, cit. [cfr. note 1], pp. 107-108. Caroline Elam has noted to me the problematic nature of this passage, since the construction of the basilica during Giovanni de' Medici's lifetime was a corporate enterprise, not an act of individual patronage. In this passage Manetti may be confusing the role of Giovanni with that of his son Cosimo de' Medici, who after 1442 accepted sole responsibility for construction of most of the basilica. Even if Manetti has confused some of the facts, however, the account may correctly indicate that Giovanni had substantial influence over important design decisions, and that private chapel patrons were difficult to find. The other details of the account, furthermore, would seem to be

too specific to dismiss entirely. Though perhaps not factually flawless, as a first hand fifteenth century account Manetti's *Vita* must be given careful consideration.

[38] "[…] the present body of the church from the transept downward [i.e., the nave], does not conform to the aforesaid transept […]", Manetti, *Vita*, cit. [cfr. note 1], p 111.

[39] Saalman, *Filippo Brunelleschi: The Buildings*, University Park, Pennsylvania 1993, p. 107. Richard A. Goldthwaite, *The Building of Renaissance Florence: An Economic and Social History*, Baltimore 1980, pp. 98-102. Antonio Ivan Pini, "Tra orgoglio civico e 'status symbol': corporazioni d'arte e famiglie aristocratiche in San Petronio nel XIV e XV secolo", in Fanti and Lenzi, *Una basilica per una città…*, cit. [cfr. note 31], pp. 87-100.

[40] Saalman, conversely, believes that Brunelleschi took the Santa Trinita floor plan as his model for San Lorenzo. Saalman, Ivi, pp. 206-207. Saalman's detailed proposed reconstruction for this Santa Trinita-inspired scheme is problematic, however, for it includes freestanding, square, fluted, minor order columns—a device that occurs nowhere in the Brunelleschi oeuvre and would have significantly complicated Brunelleschi's otherwise lucid architectural language. For a tentative chronology of the fourteenth-century rebuilding of the Basilica of Santa Trinita see Howard Saalman, *The Church of Santa Trinita in Florence*, CAA Monograph XII, 4, 1966, pp. 37-38. Fontana, "Il Brunelleschi", cit. [cfr. note 11], p. 173. Readers should not interpret my assessments that this basilica lacks "geometrical clarity" and provides an "unremarkable interior experience" as in any way related to each other. Only according to the Wittkower Paradigm, which I do not agree with, could geometrical clarity be believed to contribute to a remarkable interior experience. Rather, I simply mean that a fifteenth-century architect, such as Dolfini or Brunelleschi, who looked at a floor plan drawing of this basilica and toured the interior is not, in my opinion, likely to have been impressed enough to have choosen this basilica as a model for a new one. I am using my aesthetic assessment here not as a form of historical evidence, but merely to suggest one way in which a fifteenth-century Florentine architect might have evaluated nearby precedents in search of appropriate models for a new work. My main argument is not based on my aesthetic opinions, but on the extensive evidence presented below that points to northern influences on the San Lorenzo design, rather than influences from the basilica of Santa Trinita. See Chapter 1 for a description of the Wittkower Paradigm.

[41] "[…] with brick piers […]". Manetti, *Vita*, cit. [cfr. note 1], p. 106.

[42] The molded brick capitals of the former nave columns in the partially-preserved Romanesque Basilica of San Pier Scheraggio (today part of the Uffizi) is the only significant, surviving medieval example of the visible use of this building material in Florentine ecclesiastical architecture.

[43] Giovanni Lorenzoni, "L'architettura", in *La Basilica di San Petronio in Bologna*, Milan 1983, pp. 53-124.

[44] Whether Dolfini intended compound piers to support a vaulted nave, or nave columns to support a flat wooden ceiling, is unknown. See note 52, below.

[45] Ackerman, "'Ars Sine Scientia Nihil Est'…", cit. [cfr. note 31], p. 88. For a high-quality color reproduction of this sketch see Christoph Luitpold Frommel, "Reflections on the Early Architectural Drawings", in Millon and Magnago Lampugnani (eds.), *The Renaissance from Brunelleschi to Michelangelo*…, cit. [cfr. note 12], p. 103 Fig. 5.

[46] That Pavia remained a destination of architectural interest more than a century after the founding of the cathedral in nearby Milan is suggested by Giuliano da Sangallo's visit to Pavia in 1492. His sketch of the "Tower of Boethius", or according to Giuliano's own label, "La Tore di Pavia" (the tower in which Severinus Boethius was imprisoned and eventually executed), is now a valuable record of the appearance of that ancient monument, which collapsed in 1584. Vittorio Prina (ed.), *Vedute di Pavia dal '500 al '700*, Pavia 1992, pp. 205, 218-219. Arioaldo moved the seat of the Longobard kingdom to Pavia in the early seventh century. Gian Piero Bognetti, "Colombano a Milano—la politica universale a le reazione barbarica", *Storia di Milano*, II, Milan 1954, p. 161. Pavia was destroyed by the Hungarians in 924, and burned in an uprising of 1004. "Pavia," *Enciclopedia italiana di scienze, lettere ed arti* 26, Rome: Istituto della Enciclopedia Italiano, 1935, p. 542. The kingdom did not reach the peak of its prosperity until the eleventh and twelfth centuries, and most Romanesque monuments in Pavia today date to the twelfth century.

[47] Giovanni Mariacher, "Bernardo e Niccolò da Venezia", *Rivista d'arte*, Anno XXIV (Serie II, Anno XIV), 1-2, 1942, pp. 12-25. Angiola Maria Romanini, "L'architettura viscontea e Bernardo da Venezia", "La certosa di Pavia dalla fondazione sino alla metà del xv secolo", and "La chiesa di S. Maria del Carmine a Milano nella prima metà del quattrocento", *Storia di Milano*, VI, 1955, pp. 611-648. Id., *L' architettura gotica in Lombardia*, I, Milan 1964, pp. 415-436.

[48] On the Viscontean works listed here see articles by Angiola Maria Romanini in *Storia di Milano*, Ibid. Romanini, *L' architettura gotica in Lombardia*, Ivi, I, pp. 415-429. See additional bibliographical references in James S. Ackerman, Postscript to "The Certosa of Pavia and the Renaissance in Milan", *Distance Points*, Cambridge, Massachusetts 1991, pp. 300-302. For a summary of the dates of Visconti rule, see "Tavola Genealogico della Famiglia Visconti – III", *Storia di Milano*, VI, 1955. For a review of documentary evidence pertaining to the beginning date of construction of the Carmine, see Faustino Gianani, *Il Carmine di Pavia: storia e guida del grande monumento*, Pavia 1962, p. 13. Romanini, "L'architettura viscontea e Bernardo da Venezia", Ivi, pp.

613-615; Romanini, *L' architettura gotica in Lombardia*, Ivi, I, pp. 419, and 475 note 13. Hermann Oertel, *Die baugeschichte der kirche "S. Maria del Carmine" in Pavia*, Pavia 1936, pp. 17-35.

[49] For the comparison with the Cathedral of Florence, see Lorenzoni, "L'architettura", cit. [cfr. note 42], p. 60.

[50] Ackerman, "'Ars Sine Scientia Nihil Est'…", cit. [cfr. note 31], pp. 87-111.

[51] Gianani provides simple single-line diagrams comparing the nave bay systems of the basilicas of San Petronio and Santa Maria del Carmine of Pavia. Gianani, *Il Carmine di Pavia…*, cit. [cfr. note 48], p. 20. Lorenzoni notes that San Petronio has lateral chapels similar to those of the Carmine of Pavia. Lorenzoni, "L'architettura", cit. [cfr. note 42], p. 60.

[52] On Dolfini's contributions to the present San Lorenzo floor plan see note 4. On the question of whether Dolfini might have intended the basilica of San Lorenzo to have either compound nave piers or freestanding nave columns, perhaps of brick (see note 41), the Basilica of San Tommaso in Pavia is a relevant precedent to examine. This imposing brick basilica, today deconsecrated, partially demolished and converted into offices, was begun c. 1400, and has a nave lined with two colonnades of six massive brick columns each. The basilica, which has no nave chapels, was built with a flat wooden ceiling, but may have originally been intended to be vaulted. The authorship is unknown, though it resembles works of Bernardo da Venezia. Thus, the Basilica of San Tommaso provides a late medieval example of a colonnaded, flat-ceilinged nave similar to both those of the Basilica of San Lorenzo in Florence and the Early Christian basilica type. On San Tommaso see: Angiola Maria Romanini, *L'architettura Gotica in Lombardia*, I, Milan 1964, p. 465. Ermanno Arslan and Maria Grazia Bossi, "La chiesa di S. Tommaso in Pavia nella sua ambientazione urbanistica", *Atti del convegno si studio sul centro storico di Pavia, 4-5 luglio 1964*, Pavia 1968, pp. 305-311.

[53] For *trecento* evidence of the 16 br. *milanesi* grid of the Cathedral of Milan floor plan, see the letter and diagram of the late fourteenth century mathematician Stornaloco. Paul Frankl, "The Secret of the Mediaeval Masons", *The Art Bulletin*, XXVII, 1, 1945, p. 53. For documentary and observation-based evidence of the 11 br. *fiorentine* grid of Santo Spirito see Leonardo Benevolo, Stefano Chieffi and Giulio Mezzetti, "Indagine sul S. Spirito di Brunelleschi", *Quaderni dell'istituto di storia dell'architettura*, XV, 85-90, 1968, p. 4; and Appendix 9.3.

[54] The Gothic-period sketchbook of Villard de Honnecourt contains a simple sketch of a grid-based cathedral floor plan that resembles both those of the Cathedral of Milan and the Basilica of Santo Spirito. The caption inscribed below the sketch reads: "This is a square church designed for the Cistercian Order", thus indicating a possible, ultimate source of these plans. The word "square" in

this context perhaps refers to the regular grid. Theodore Bowie, ed, *The Sketchbook of Villard de Honnecourt*, Bloomington and London, 1959, pp. 92-93, Plate 41.

[55] In 1922 Fontana noted that the Cathedral of Pisa had long been believed to have suggested to Brunelleschi both the general form of the Santo Spirito floor plan, and the idea of continuing the colonnades around the transept arms and apse. Fontana, "Il Brunelleschi" [cfr. note 11], p. 173.

[56] In contrast to Manetti's warning pertaining to the basilica of San Lorenzo that "[…] stimandosi di Filippo, si stimerebbe el falso, e non v'è punto drento l'onore suo" ("[…] judging it as Filippo's would be to judge falsely, because his honor is not in it"; Manetti, *Vita*, cit. [cfr. note 1], p. 111), regarding Santo Spirito Manetti notes that Brunelleschi himself commented with satisfaction "[…] gli pareva avere posto una chiesa secondo la sua intenzione in quanto al composto dello edificio" ("[…] that it seemed to him that he had founded a church according to his intention, as far as the arrangement of its parts was concerned"; Manetti, Ivi, pp. 123-124). Manetti furthermore tells us that Brunelleschi documented his Santo Spirito design with "un modello di legname a braccia piccolo" ("a wooden scale model"; Manetti, Ivi, p. 122), and that in overseeing the first phase of construction, which probably began around 1436, "E certamente se del modello e' non si usciva" ("[…] certainly he did not depart from the model […]"; Manetti, Ivi, p. 124). Evidence suggests that even decades later, this model was still respected as the authoritative record of the master's design. A document of 1477 pertaining to the activity of the construction workers notes, for example, "[…] si seguissi il modello di Filippo in tutto" ("[…] they say that they followed Filippo's model completely"). Carlo Botto, "L'edificazione della Chiesa di Santo Spirito in Firenze", *Rivista d'arte*, XIII, 1931, pp. 501-502). For documentary evidence of construction as early as 22 March 1436 (modern style), see Eugenio Luporini, *Brunelleschi: forma e ragione*, Milan, 1964, p. 231, Doc. 2. Francesco Quinterio, "Un tempio per la Repubblica: la chiesa dei SS. Maria, Matteo, e dello Santo Spirito in Firenze: dal primo nucleo duecentesco al projetto brunelleschiano," *Quaderno dell'Istituto di storia dell'architettura*, 1990, no. 15-20, p. 307. Francesco Quinterio, "Il cantiere della chiesa: il vestibolo e la sagrestia," in *La chiesa e il convento di Santo Spirito a Firenze*, Cristina Acidini Luchinat, ed., Florence, 1996, p. 109.

[57] According to my partial survey of the Carmine of Pavia and my complete survey of the Basilica of Santo Spirito, the column diameters of the Carmine (both 91.1 cm, in the sample measurements in Figure 5-7) are 2-3 cm thicker than those of Santo Spirito (88.9 cm and 87.9 cm in the sample measurements in Figure 5-8). In the Carmine, however, the clear distance between adjacent engaged column shafts that face in toward the aisles, measured in the longitudinal direction (529.9 cm in the sample measurement in Figure 5-7), is 26.5 cm less than the corresponding clear distance at Santo

Spirito (556.4 cm in the sample measurement in Figure 5-8). Thus, the Carmine column shafts are slightly thicker than those of Santo Spirito, and stand about one-third of a column diameter closer together than the corresponding columns of Santo Spirito. For the complete Santo Spirito survey, see Appendix 9.3. Brunelleschi's apparent desire to recreate the effect of perspectival foreshortening that he observed in the Carmine of Pavia thus constitutes a third possible reason for his reduction of the intercolumniations from 9 2/3 br., plinth to plinth, used at San Lorenzo, to 9 br. used at Santo Spirito. The other two possible reasons are number symbolism and site constraints. Ivi, p. 42.

[58] On this likely collaboration see Bruschi, *Filippo Brunelleschi*, cit. [cfr. note 12], pp. 78-85.

[59] Saalman, "Filippo Brunelleschi: Capital Studies", cit. [cfr. note 7], p. 127 n. 70. Note that Brunelleschi uses two steps in Santo Spirito, while Bernardo uses only one in the Carmine of Pavia. Variations of this step/plinth device are also found in the Basilica of San Petronio in Bologna, and the Old Sacristy of San Lorenzo.

[60] For illustrations and dates see James S. Ackerman, "The Certosa of Pavia and the Renaissance in Milan", *Marsyas*, V, 1947-49, p. 26 and Fig. 6. Ackerman, Postscript to "The Certosa of Pavia and the Renaissance in Milan", cit. [cfr. note 48], p. 301. Romanini, *L' architettura gotica in Lombardia*, I, cit. [cfr. note 47], p. 428-430.

[61] Romanini, Ivi, pp. 509-512, 519-521, 526 n.85. Brigitte Tietzel-Hellerforth, *La facciata del Duomo di Faenza ed il problema della facciata nel Rinascimento*, Faenza 1977, pp. 330-331.

[62] "[…] li contraforti del corpo dela giesia non hanno tuta quella grandeza che sareve de bisognio, conscìderando la largheza e l'alteza dela dicta giesia, vorave se reduze la prima nave in forma de capelle cum le mezature tra l'una capella e l'altra, cum alchuni strafori, per li quali se porave vedere el corpo de Cristo da l'uno con l'altro de la giesia, e fazendo così vegniarevese a dare grandissima forteza ale altre tre nave per quilli archi butanti avereve più fermo el suo principio e el corpo dela giesia parerave più bello, e più con sova rexone per che el seguireve la grandeza de la cruxe": "Addi 8 maggio 1400: Bertolino da Novara — Bernardo da Venezia ingegneri", *Annali della fabbrica del duomo di Milano: dall'origine fino al presente*, I, Milan 1877, p. 213. Romanini, Ivi, pp. 415-416. Ackerman, "The Certosa of Pavia", cit. [cfr. note 60], p. 25. Ackerman, "'Ars Sine Scientia Nihil Est…'", cit. [cfr. note 31], p. 92.

[63] Romanini, *L' architettura gotica in Lombardia*, I, cit. [cfr. note 47], pp. 421-422.

[64] Although the minor order columns at Cerreto are too short relative to their diameters to appear classically proportioned, they currently lack bases, perhaps indicating that the floor level has been raised. Cf. Romanini, Ivi, p. 55 n. 30, 421-422. For Romanini's observations regarding a Lombard Romanesque revival in Pavia see Romanini, "L'architettura viscontea e Bernardo da Venezia", "La

certosa di Pavia dalla fondazione sino alla metà del xv secolo", and "La chiesa di S. Maria del Carmine a Milano nella prima metà del quattrocento", in *Storia di Milano*, VI, 1955, pp. 620-621.

[65] Double scotia column bases are found in the church of Santa Maria di Gradaro in Mantua, c. 1256-1260, but considering the short proportions of the columns their usage there appears more regionally idiosyncratic than deliberately Romanizing. Romanini, I, cit. [cfr. note 47], p. 155 and II, Tav. 58-B. On the importance of the double scotia base in the development of Renaissance architectural theory, see Howard Burns, "Baldassarre Peruzzi and Sixteenth-Century Architectural Theory", in André Chastel and Jean Guillaume, eds., *Les traités d'architecture de la renaissance*, Paris 1988, pp. 207-226. Perhaps Bernardo da Venezia even made a sketch of Roman examples of the double scotia base in Rome itself, similar to the mid-sixteenth century sketch made by Baldassare Peruzzi, reproduced in Burns, "Baldassarre Peruzzi…", Ivi, p. 224, Fig. 18.

[66] Saalman, "Capital Studies…", cit. [cfr. note 7], p. 115.

[67] Another detail that reveals Brunelleschi's intended reduction and regularization of Tuscan Romanesque forms is the down-turning architrave of the Ospedale degli Innocenti façade which, according to the fifteenth-century chronicler Antonio Billi, Brunelleschi never intended. According to Billi, when Brunelleschi had to be away during construction of the façade, his surrogate copied the detail from the Baptistery of Florence, not realizing that Brunelleschi considered that particular detail to be the one error in that building. Fabio Benedettucci (ed.), *Il libro di Antonio Billi*, Rome 1991, p. 34.

[68] See note 7.

[69] Ackerman, "The Certosa of Pavia", cit. [cfr. note 60], pp. 23, 33.

[70] Cf. Burns' comments regarding the concept of "Survival and Revival" in relation to antique forms in the *quattrocento*. Burns, "Quattrocento Architecture…", cit. [cfr. note 7], p. 270.

[71] Ivi, 24

[72] Ivi, 33

[73] Ackerman, "The Certosa of Pavia", Ivi, pp. 30-34. Ian Campbell, "A Romanesque Revival and the Early Renaissance in Scotland, c. 1380-1513", *Journal of the Society of Architectural Historians* LIV, 3, 1995, pp. 302-325.

[74] In the mid-fifteenth century Flavio Biondo described the *pietra serena* columns of San Lorenzo as being of marble, thus indicating his identification of this work with ancient Roman works. Burns, "Quattrocento Architecture…", cit. [cfr. note 7], p. 273.

I thank the Opera di Santa Maria del Fiore and geom. Paolo Bianchini, Responsabile del Ufficio Tecnico for permission to measure the Basilica of Santa Maria del Fiore; Matthias Feldmann, Stefano Guiducci, and Ursula Winkler for assistance with field work, and Franklin Toker and Jack Wasserman for their thoughtful comments on the ms. Research was made possible by a 2005 Washington State University New Faculty Seed Grant from the WSU Foundation and the Office of the Vice Provost for Research.

[75] Cohen, "How Much Brunelleschi?," 18-57.

[76] H.W. Janson, *History of Art: a Survey of the Major Visual Arts from the Dawn of History to the Present Day*, II ed., Englewood Cliffs, New Jersey, 1977, p. 389; III ed., 1986, p. 409; and ("radical change") VI ed., 2001, p. 397. In the current edition "radical" has been removed but the intent remains essentially unchanged: "[…] a new emphasis on symmetry and regularity distinguishes [Brunelleschi's] design for San Lorenzo [from Gothic precedents] […]". *Janson's History of Art: The Western Tradition*, VII ed. by Penelope J. E. Davies et al., Upper Saddle River, New Jersey, 2007, p. 513.

[77] I paraphrase here John Summerson, who proposes "[…] to modify the customary view of Gothic and classic art as "opposites"; and in fact […]" he continues, "[…] this habitual antithesis is in many ways highly unsatisfactory. It is a too obvious conclusion drawn from *prima facie* impressions". J. Summerson, "Antitheses of the Quattrocento," in Idem, *Heavenly Mansions and Other Essays on Architecture*, New York and London, W.W. Norton 1963, p. 24. For a bibliography of previous studies of the architectural proportions of the Basilica of San Lorenzo, see Cohen, "How Much Brunelleschi?," cit., Appendix 2.

[78] Rudolf Wittkower, the most influential exponent of this position, contends: "I think it is not going too far to regard commensurability of measure as the nodal point of Renaissance aesthetics. […] While to the organic, metrical Renaissance view of the world rational measure was a *sine qua non*, for the logical, predominantly Aristotelian Middle Ages the problem of metrical measure could hardly be of similar urgency. […] On the contrary, the medieval quest for ultimate truth behind appearances was perfectly answered by geometrical configurations of a decisively fundamental nature; that is, by geometrical forms which were irreconcilable with the organic structure of figure and building." R. Wittkower, *Architectural Principles in the Age of Humanism*, New York and London, W.W. Norton 1971, pp. 158-159. More specifically, Wittkower associates his belief in what he perceives as "[…] the metrical discipline of buildings like S. Lorenzo or S, Spirito […]" with his belief that those buildings contain mathematically rational sets of proportions in his highly influential article: Idem, Brunelleschi and "Proportion in Perspective," *Journal of the Warburg and Courtauld Institutes* 16, 3/4, 1953, p. 289.

[79] For this attribution see Cohen, "How Much Brunelleschi?," cit., pp. 41-44; and Idem, *Matthew Cohen's Reply* to Letter to the Editor by Volker Herzner, "Journal of the Society of Architectural Historians", LXVII, 4, 2008, pp. 634-635. In the present study I use the terms 'architect' and *capomaestro* to indicate the primary designer and highest-level construction supervisor at any particular time, a double role that I believe both Dolfini and Brunelleschi filled consecutively at the Basilica of San Lorenzo (though each may have delegated day-to-today construction supervision to a surrogate). This interpretation of Dolfini's architect status receives support from Brunelleschi's fifteenth-century biographer, Antonio di Tuccio Manetti, who notes that Dolfini "[…] had a knowledge equal to that of other architects of the time". Thus, by his reference to *other* architects, Manetti implies that he considered Dolfini to be an architect as well. A. Manetti, *Vita di Filippo Brunelleschi*, ed. by G. Tanturli, Milan, Edizioni il Polifilo, 1976. p. 106. On the varied meaning of the term "architect" during the medieval period see N. Pevsner, *The Term Architect in the Middle Ages*, "Speculum", 1942, pp. 549-562.

[80] For a previous study of the interior proportions of this basilica, which makes use of neither measurements nor available documents, see L. Gori-Montanelli, "Il sistema proporzionale dell'interno del duomo di Firenze," in *Festschrift Ulrich Middeldorf*, ed. by Herausgeben von Antije Kosegarten and Peter Tigler, Berlin 1968, pp. 64-72.

[81] On the possible role of similar late-medieval, slightly pointed arches in Dolfini's design for the Basilica of San Lorenzo prior to Brunelleschi's modifications, see Cohen, "How Much Brunelleschi?," cit., p. 42.

[82] B. Sansone Sgrilli, *Descrizione e studi dell'insigne fabbrica di S. Maria del Fiore*, Florence, Bernardo Paperini 1733 [rpt. Florence 1996], figs. II and IV; and G. Rocchi et al., *S. Maria del Fiore. Il corpo basilicale. Rilievi, documenti, indagini strumentali. Interpretazione*, Milan, Ulrico Hoepli 1988, tav. 1-2. The drawings published by Sgrilli and Rocchi et al. show slight variations in the nave arcade bay widths, but smaller and distributed differently than the actual variations. These previously-published dimensional variations are probably unintentional graphic distortions resulting from the publication process. Rocchi et al. note a slight narrowing of the central nave from west to east, and slight trapezoidal distortions in some of the nave bays, but make no mention of significant bay width irregularities. *Ibidem*, tav. 2, caption. Although Rocchi et al. present a large, detailed floor plan annotated with hundreds of measurements, none of them are useful for proportional analysis because virtually all of them are triangulations between points of measurement randomly located on the pavement, away from corners, edges and central axes of architectural features. *Ibidem*, tav. 2.

[83] Uzielli claims that on 18 April 1896 he measured, with the help of a certain carpenter Gabriello Bencini, two inter-axial distances between unspecified nave piers in the longitudinal direction, and two more in the transverse direction. He then claims to have taken the average of each pair of measurements, converted them to Florentine *braccia* using the nineteenth-century value for the *braccio* of 58.36 cm, and compared them to the corresponding dimensions noted in a cathedral document of 1357. Although he provides neither measurements nor calculations, he claims that his measurements correspond precisely to the 1357 specifications, within 1 mm, because the 1357 specifications produce a metric value for the Florentine *braccio* in use in 1357 of 58.35 cm. He thus deduces that the Florentine braccio remained invariable during the intervening centuries. Uzielli's story is probably invented, for given the large variations in the distances between the nave piers (both longitudinal and transversal), no combination of measurements would produce the results he reports, much less within 1 mm of discrepancy; and in any case he would have been remiss in failing to report the substantial variations in the inter-axial distances that he would have discovered if indeed he had undertaken the survey he describes. G. Uzielli, *Le misure lineari medioevali e l'effigie di Cristo*, Florence, Bernardo Seeber, 1899, pp. 13-14.

[84] I began the Santa Maria del Fiore survey in June 2005 with a steel tape measure manufactured by SEB, and continued it in June 2008 using a Leica Disto A5 laser measuring device. In 2008 I checked many of the 2005 measurements with the laser and found the results to be very consistent, with discrepancies in the range of 0-8 mm. I measured some of the vertical dimensions from a mobile scaffolding provided by the *Opera* of Santa Maria del Fiore, and others from the upper gallery (*ballatoio*).

[85] In this study one Florentine *braccio* is assumed to measure 58.36 cm. When no simple fractional equivalent for a partial *braccio* is implied, such remainders are expressed in modern English decimal notation. Cfr. Cohen, "How Much Brunelleschi?," cit., pp. 27 and 53 note 50.

[86] "Seguasi fino poste le due colonne et volti gli archi, et inanzi che vada più inanzi se n'abi consiglio." *Santa maria del Fiore. La costruzione della chiesa e del campanile*, ed. by C. Guasti, Florence, Loescher & Seeber 1887, p. 82.

[87] *Ibidem*, p. 84.

[88] "E che e' s'intenda essere di spazio da meza cholonna a meza cholonna br. xxxiij 3/8 1/1 per lo largho. E per lo lungho br. xxxiiij. Di che seguitano iij volte l'una dopo l'altra per lo lungho da meza colonna a meza colonna per largho br. trentatre e tre ottavi e mezo: per lo lungho, br. trentaquattro, da meza a meza cholonna". *Ibidem*, p. 94. Note that consistent with fourteenth and fifteenth-century documents, in my translation I have transcribed the fractions with horizontal bars instead of Guasti's

diagonal slashes. I have not been able to verify the actual form used in the cathedral archives in question.

[89] The nave pier plinths are roughly Greek Cross shaped. The plinths of Piers 1-3 and 8-10 (Figure 5-18) measure nearly exactly 5 br from end to end, in both the east-west and north-south directions. Those of Piers 4-7 measure about 5.19 br. Since the latter were built in what were most likely the later phases of nave construction (see below), I will assume that the 5 br plinth dimension is the one originally intended.

[90] In the south nave arcade, the westernmost bay measures 1692.1 cm, which exceeds 29 br (1692.44 cm) by a negligible 3.4 mm. The corresponding bay in the north arcade measures 1690.6 cm, or just 1.8 cm less than exactly 29 br (Figure 5-18).

[91] Toker suggests that the fourth bay may have been added in order to achieve metrical superiority over the Cathedral of Siena. M. Toker, "Florence Cathedral: the Design Stage," *Art Bulletin* 60, 2, 1978, pp. 226-227; and Idem, "Arnolfo's S. Maria del Fiore: A Working Hypothesis," *Journal of the Society of Architectural Historians* 42, no. 2, 1978, p. 104ff. Trachtenberg proposes that the fourth bay was added in order to bring the total interior nave length (assuming four ideal bays measuring 34 br on center, plus the 8 br inner faces of the western crossing piers) to 144 br, and therefore into conformance with a "proportional chain" of numerical relationships that he identifies. M. Trachtenberg, "Architecture and Music Reunited: A New Reading of Dufay's" *Nuper Rosarum Flores* and the Cathedral of Florence," *Renaissance Quarterly* 54, no. 3, 2001, pp. 751-754. On the basilica construction history see also H. Saalman, "Santa Maria del Fiore: 1294-1418," *Art Bulletin* 46, no. 4, 1964, pp. 471-500.

[92] Toker, *ibidem*, 1983, p. 108ff. Franklin Toker has indicated to me that while he believes, based on available documentary evidence, that Arnolfo started construction simultaneously from both the west and the east in 1293, he has never thought that true of Talenti and his contemporaries half a century later.

[93] One apparently intentional architectural refinement in this basilica is the gradual narrowing of the nave width from 28.57 br (1667.5 cm) at the interior façade, to 27.93 br (1630.0 cm) at the entrance to the octagon; a difference of nearly $\frac{2}{3}$ br (0.64 br), or, 37.5 cm (Figure 5-18); also noted by Rocchi et al., in *Santa Maria del Fiore* cit., tav. 2, caption (see note 9, above). No such narrowing is indicated in the surviving documents of the *Opera*, however, which simply specify that the central nave was to measure $33\frac{1}{2}$ br on center (measured north to south). Therefore, this refinement appears

to have been added (perhaps on site by the masons) after the official dimensional specifications were established. See discussion of the dimension 33 $\frac{1}{2}$ br below, and Cohen, “How Much Brunelleschi?” cit., p. 54 note 62.

[94] The ten nave pier shaft heights are very consistent from one to the next (Figures 5-19 and 5-21). The maximum variation is 6.3 cm, but the more useful calculation for evaluating the extent of the variation in these pier shaft heights is the standard deviation, which is a mere 1.84 cm. While a calculation of the mean (average) pier shaft height is not, strictly speaking, a mathematically sound basis for a proportional analysis, considering the small number of pier heights in question and the low standard deviation, the mean does not differ much from each individual nave pier height, and so serves as a reasonably accurate representative for all ten pier heights.

[95] Thus, the progression 1 $\frac{2}{3}$, (5 $\frac{2}{3}$), 9 $\frac{2}{3}$, 13 $\frac{2}{3}$, 17 $\frac{2}{3}$, must be read as 1, (5,) 9, 13, 17. The numbers shown in parentheses are reconstructions. Cohen, “How Much Brunelleschi?” cit., pp. 27-28.

[96] The dimension 41 br equals 2392.76 cm. Of the ten upper pier shaft heights in the nave (Figure 5-20 and 5-21, Dimension B as indicated in Figure 5-19), five of them are from 2-7 cm taller than 41 br, and four are from 2-4 cm shorter. The remaining height (Pier 3), which is 15.3 cm taller than 41 br (2392.76 cm), is aberrational perhaps due to construction or measurement error.

[97] The ratio 29:41 approximates the ratio 1:√2 within 0.03%. Cohen, “How Much Brunelleschi?” cit., p. 32.

[98] See note 22 above.

[99] Cohen, “How Much Brunelleschi?” cit., pp. 33 and 53 note 42.

[100] The treatise was translated in the mid-fifteenth century by Marsilio Ficino for Cosimo de’ Medici, but could have arrived in Florence earlier; for example, at the end of the fourteenth century when the Ottoman Turks encroached into Byzantine territory and Greek-speaking men of learning took refuge in Italy. *Ibidem*, p. 32.

[101] Cohen, “How Much Brunelleschi?” cit., pp. 21-24.

[102] See Chapter 6.2.

[103] “Che il fondamento delle cholonne dallo spazo in giù si faccia br. vij per ognie verso, quadro, fino alla buona ghiaia entro l’aqua”. *Santa Maria del Fiore*, ed. by Guasti cit., p. 94.

[104] Cohen, “How Much Brunelleschi?” cit., pp. 28, 33-37.

[105] Cohen, “How Much Brunelleschi?” cit., p. 32.

[106] S. Serlio *Il quinto libro d'architettura* […] *nel quale si tratta di diverse forme de'tempj sacri*, Paris 1547, *fol*. 2v. The Vitruvian passage to which Serlio refers is probably *de Architectura*, III.iv.1. In it, however, Vitruvius notes that walls supporting columns should be "[…] thicker by one half than the columns […]", and thus denotes the ratio $1{:}1\frac{1}{2}$, not $1{:}\sqrt{2}$.

[107] The San Lorenzo nave arcade bay set of proportions embodies geometrical precision in the overlap of the square, root-2 rectangle and dual diagon, when all three figures are drawn to touch the nearer and farther edges of adjacent column plinths (Figure 4-12). It embodies mathematical precision in the approximation of the ratio $1{:}\sqrt{2}$ with the ratio $9\frac{2}{3} : 13\frac{2}{3}$, which is accurate to within 0.03% (3 mm at the scale of the San Lorenzo nave arcades), or, more than ten times more accurate than the most accurately constructed masonry work in that basilica. Cfr. Cohen, "How Much Brunelleschi?" cit., p. 32.

[108] In the San Lorenzo nave arcade bay set of proportions, when a square and root-2 rectangle are drawn to touch the edges of two adjacent column plinths, their top lines overlap perfectly (Figure 4-12). Probably due to construction error, however, the heights of the column shafts are taller than the top of this overlapping figure by 11-12 cm. See Chapter 2 and Cohen, "How Much Brunelleschi?" cit., pp. 33-37. In the Santa Maria del Fiore nave arcade bay set of proportions, by contrast, when an overlapping square-and-a-half and two-square rectangle are drawn to touch the edges of two adjacent nave pier plinths, their top lines fail to overlap by 9.75 cm. The tops of the nave pier shafts arrive precisely in the middle of this gap.

6. Alternatives to the Wittkower Paradigm

The preceding chapters constitute a fundamental challenge to the Wittkower Paradigm. The first of the three characteristics of the Wittkower Paradigm, the premise that certain sets of proportions determine the aesthetic character of architecture, including the aesthetic distinctions between architectural styles, would seem to be entirely without foundation in light of the findings of this study. The vertical sets of proportions found in the Old Sacristy, if they can be considered intentional sets of proportions at all, have little geometrical or numerical interest, yet art and architectural historians consider the Old Sacristy to be a masterpiece of Renaissance architecture. According to what principles—aesthetic, philosophical, scientific or otherwise—could these sets of proportions contribute to the aesthetic appeal of that building? The same may be asked in relation to the basilica of Santo Spirito, since the set of proportions found in the nave arcade bays appears cursory and carelessly conceived compared to those of San Lorenzo. Even the sets of proportions of San Lorenzo, we have seen, contain significant errors and irregularities, yet neither critics nor historians have ever questioned the aesthetic quality of the building or its pivotal role in the history of architecture.

Furthermore, we have seen that the Gothic-style basilica of Santa Maria del Fiore and the Renaissance-style basilica of San Lorenzo contain similar sets of proportions, as do the Gothic-style Cathedral of Milan and the Renaissance-style basilica of Santo Spirito, thus indicating, contrary to the Wittkower Paradigm, that sets of proportions are stylistically neutral. That the second premise of the Wittkower Paradigm, suppression of the object in favor of documentary research, is an unnecessarily limiting approach to the study of architectural proportion (proportion-1 and proportion-3) is indicated by the many conclusions presented in this study that are based on evidence that is only accessible through observation.

The third characteristic of the Wittkower Paradigm, the theory of Geometry vs. Number, or, the theory that the transition from the medieval to the Renaissance periods was accompanied by, according to Wittkower, a "[…] transition from a primarily geometrical to an arithmetical approach to proportion," finds no expression in any of the sets of proportions examined in this study.[1] The sets of proportions in the fourteenth-century nave arcade bays of the basilica of Santa Maria del Fiore appear to accord equal importance to both geometry and number, as do those of the nave arcade bays of the basilica of San Lorenzo.

While the latter falls under Wittkower's *quattrocento* exception of the theory of Geometry vs. Number within the Wittkower Paradigm (see Chapter 1), the throughness and sophistication with which geometry and number are blended in the San Lorenzo sets of proportions challenges the validity of both this exception and the theory. The combinations of geometry and number found there appear to be the results of centuries of development rather than a temporary, transitional phase in the history of geometry and mathematics. Furthermore, the Santa Maria del Fiore evidence indicates that the *quattrocento* was not preceded, as Wittkower claims, by a medieval period that emphasized geometry over number. Indeed, Theon of Smyrna's formula for generating accurate numerical approximations of the ratio $1:\sqrt{2}$ appeared some 1300 years before Dolfini began his work on that basilica, and such approximations (if not Theon's forumal) were known throughout the medieval period.[2]

The preceding chapters not only challenge the Wittkower Paradigm, but suggest alternatives to it that I will now explore, beginning with the third characteristic of the paradigm. While the evidence presented in this study challenges the main premises of Geometry vs. Number, it is consistent with this theory at least insofar as it seems to confirm that the medieval and Renaissance periods exhibited notable differences in their attitudes toward geometry and number. Those differences do not appear to have been characterized by preferences for one over the other, however, since geometry and number do not ever appear to have been separated in the history of architecture, but rather, by ever-increasing degrees of precision in quantification. This proposal can be elucidated through further analysis of the sets of proportions found in the nave arcade bays of Santa Maria del Fiore, considered in the context of fourteenth-century developments in mathematics.

6.1. The Crosby Thesis Instead of Geometry vs. Number

The mid-fourteenth century was a period of transition in the history of mathematics. Hindu-Arabic numerals began to appear together with the older Roman numerals in treatises on arithmetic in Europe as early as the late 11th and early 12th centuries, but Roman numerals were still preferred in these works for calculation.[3] Roman numerals, however, being non-positional and lacking a symbol for zero, made calculation cumbersome. By the end of the 13th century, Hindu-Arabic numerals had become so common as instruments of calculation in Florence that in 1299 a statute of the *Arte del Cambio* (the guild of the money changers) was enacted to prohibit their use.[4] Perhaps, as Dirk Struik suggests, the supporters of the statute saw the new number system as an asset of the *Arte del Cambio* that could be profitably withheld from others.[5] Similar prohibitions were enacted in Padua in 1348.[6] Ball proposes that "[…] by the year 1400, we may consider that the Arabic symbols were generally known throughout Europe, and were used in most scientific and astronomical works."[7] The archives of the *Opera* of Santa Maria del Fiore seem to support this estimate. The document of 1357 quoted above specifies dimensions in Roman numerals, but a few decades later in these archives Hindu-Arabic numerals appear with increasing frequency.[8] The historical development of fractional, rather than whole number, notation provides a more detailed view into the development of calculation with Hindu-Arabic numerals.

Roman Fractions

The use of Roman numerals combined with fractions composed of Hindu-Arabic numerals appears to have gained wide acceptance slightly before the use of Hindu-Arabic numerals for both whole numbers and fractions, probably because the Roman system of fractions is so unwieldy. It is a system in which all fractions are based on twelfths, and in which a finite number of fractions is recognized. These fractions are represented by obscure, never fully-standardized symbols that are as difficult to remember as to distinguish from one another. Each increment of twelfths, from $\frac{1}{12}$ to $\frac{12}{12}$, has its own unique symbol, and certain fractions smaller than $\frac{1}{12}$ are represented by yet more unique symbols (Figure 6-1).[9]

When a fraction is needed that either is not a factor of $\frac{1}{12}$, or, if smaller than $\frac{1}{12}$, has a numerator greater than one, such a fraction has to be formed by combining available fractions. One such example is $\frac{1}{8}$ which, apparently because of its usefulness, has its own symbol even though its name refers to other fractions. Thus in the Roman system of fractions $\frac{1}{8}$ is simply understood as one-and-a-half twelfths ($\frac{1}{12}+\frac{1}{24} = \frac{1}{8}$), as its name *sescuncia*, or "inch and a half", implies (Figure 6-1). The arithmetician who needs the fraction $\frac{11}{144}$, however, is not so fortunate. This fraction must be expressed as $\frac{1}{24}$ (*semuncia*) + $\frac{1}{36}$ (*duella*) + $\frac{1}{144}$ (*hemisecla*), and such combinations must be memorized, for Roman fractional notation, like Roman numeration in general, is not conducive to calculation. Rather, according to Gillian Evans, in order to subdivide the quantity of "one" this system requires a "shift in thinking"; a shift that I would describe as more verbal than mathematical.[10]

Evans observes that the arithmetician " […] begins by renaming his unit an *as* [$\frac{12}{12}$], and this seems to be a signal for him to begin to think of it as a whole, divisible into twelve parts…."[11] Returning to the sets of proportions in the nave arcade bays of the basilica of Santa Maria del Fiore, we now see how simple it would have been for Talenti, who was perhaps trained in the Roman system of fractions in his youth, to determine the mean between 19 $\frac{1}{3}$ br and 19 $\frac{1}{2}$ br. No calculation would have been required, but rather, a "shift in thinking" and a correct selection of words. In the Roman system of fractions, $\frac{1}{3}$, called *triens* ("one third") is understood to equal $\frac{4}{12}$. The fraction $\frac{1}{2}$, called *semis* ("half") is understood to equal $\frac{6}{12}$. Talenti merely had to select the fraction that falls between them, called *quincunx* ("five twelfths") and append it to 19 in order to determine the height of the nave pier shafts, 9 $\frac{5}{12}$ br. Thus, calculation with Roman fractions is essentially a qualitative, verbal procedure. As such, it has a notable parallel with some of the earliest fractional notations recorded in the fourteenth-century Florentine cathedral archives.

Verbal Fractions

The collection of documents pertaining to the Basilica of Santa Maria del Fiore published by Guasti in 1887 provides a convenient case study in the evolution of fractional notation from the late thirteenth to the early fifteenth centuries in Florence. A document dated January 5, 1351 (new style), for example, contains numerous examples of verbal fractions, such as: "in length one *braccio* and one-half of another *braccio*" (*longitudinis unius bracchii et dimidii alterius bracchii*), "in width two-thirds of a *braccio*" (*largitudinis duorum tertiorum bracchii*), and "in width one *braccio* and one-eight part of another *braccio*" (*largitudinis unius bracchii et octave partis alterius bracchii*).[12] Similar to Roman fractions in that they are verbal, but dissimilar in that they use only common Latin terms to denote fractional quantities, these verbal fractions perhaps indicate that the complex system of Roman fractions found only limited use.

Serial Fractions

Seven years later in the Guasti transcriptions, a new system of fractional notation appears. Now Roman numerals are followed by a string of interdependent fractions that I will term "serial fractions". These fractions contain only Hindu-Arabic numerals, as in the dimension br. xxxiij $\frac{3}{8}\,\frac{1}{1}$, which is the specification for the Santa Maria del Fiore nave width, measured on center, that immediately precedes the 34 br specification in the 1357 document discussed above.[13] This strange and complex system of fractional notation, which according to Louis Charles Karpinski originates in the ancient Egyptian system of "unit fractions", but which I find also reminiscent of Roman fractions, gained a foothold in the Latin West in part through its use by Leonardo of Pisa (alias

Fibonacci, ca. 1175–ca. 1250), in his *Liber abaci* of 1202.[14] It appears to have gained wide enough acceptance in Florence to have delayed the definitive adoption of common fractions (the system that we use today, which happens to be another system described by Leonardo of Pisa) until the end of the fourteenth century.[15]

In the preceding example, $33\,\frac{3}{8}\,\frac{1}{1}$, the second fraction denotes a fractional portion of the denominator of the first. Thus, the serial fraction $\frac{3}{8}\,\frac{1}{1}$ must be read: $\frac{3}{8}+\frac{1}{8}=\frac{1}{2}$. This interpretation is consistent with the teaching found in a contemporary schoolbook on arithmetic, discussed in detail below. Thus the total dimension noted above equals $33\,\frac{1}{2}$ br. The hapless scribe of the aforementioned 1357 document appears to have been sufficiently confused by this system that as a precaution he repeated the dimension, apparently incorrectly, in the old verbal system as: "thirty-three and three-eighths and a half *braccia*" (*br. trentatre e tre ottavi e mezo*); or $33\,\frac{3}{8}+\frac{1}{2}=33\,\frac{7}{8}$ in modern notation.[16] My survey supports the first interpretation, rather than the scribe's. The nave width, measured between the plinths of the engaged piers on the interior façade (because this westernmost bay of the nave is the most likely to reflect the dimensions in the 1357 document, as noted above) is 1667.5 cm (Figure 5-18, between Piers 1 and 10), or 28.57 br; or, only 4 cm larger than $28\,\frac{1}{2}$ br plinth to plinth; or, virtually the same as the specified dimension of $33\,\frac{1}{2}$ br on center once we add 5 br for half the width of each plinth on either side.

Common Fractions

Judging from our limited sample in the *Opera* documents transcribed by Guasti, and other evidence discussed below, serial fractions appear to have been short-lived in Florence, having been supplanted by common fractions at about the same time that Roman numerals finally gave way to Hindu-Arabic numerals as the primary form of numeration. Thus, in a document of 1411 we find a *braccio* dimension expressed as an Hindu-Arabic numeral plus a common fraction: "124 and $\frac{23}{24}$ *braccia*" (*brachiis 124 et* $\frac{23}{24}$).[17]

This new system would seem to have appeared just in time from the point-of-view of the cathedral accountants who had to figure out how much, according to the aforementioned document of 1411, Ugho de Alessandris was owed for the $124\,\frac{23}{24}$ br of wood planks he supplied, at a monetary rate of 8 *soldi* and 4 *denari* per *braccio*, to be used in the centering of the squinches and occuli of the cathedral tambour.[18] The calculation would have been far more laborious had the fraction $\frac{23}{24}$ been expressed as a serial fraction. We can begin to appreciate just how laborious by perusing a Florentine schoolbook of arithmetic, or *trattato d'abbaco*, written by a noted mathematician about forty years earlier.

A more accurate title for the *Trattato d'aritmetica*, or, *Treatise on Arithmetic*, written by Paolo dell'Abbaco probably around 1373, might have been *Treatise on Common Fractions*, for the purpose of the work appears to have been to explore every aspect of the then-new system of common fractional arithmetic that might have had any practical application.[19] Paolo's 197 problems range from simple exercises such as: "divide 12 by $3\frac{1}{4}$ " (Problem 2) and "multiply $5\frac{1}{4}$ by $8\frac{3}{5}$ " (Problem 14), to complex word problems involving areas of cloth (Problem 36), divisions of a testament (Problem 100), the length of a hemp rope strung between two towers to support a lead weight (Problem 158), and many other situations.[20] Paolo apparently wanted to make sure his students understood the older system of serial fractions before moving on to common fractions, and so his first problem is devoted to a serial fraction equivalent to, as it turns out, the common fraction $\frac{23}{24}$.

Paolo explains at length that the serial fraction $\frac{2}{3}\,\frac{1}{2}\,\frac{3}{4}$ must be read, in effect: "two thirds, plus one half of one third, plus three quarters of one half of one third", or, $\frac{2}{3} + \frac{1}{6} + \frac{1}{8}$, or $\frac{16}{24} + \frac{4}{24} + \frac{3}{24}$, or $\frac{23}{24}$. He also describes a shortcut for carrying out this conversion that, if it is indeed a shortcut, leaves us marveling over how such a complicated system of fractional notation could ever have come into being.[21] Paolo himself seems to have shared this view, for he ends this first problem with apparent impatience, declaring: "and this is sufficiently clear and so, enough" (*e questo è assai chiaro e basta*).[22] Never again to return to serial fractions, he proceeds through the remaining 196 problems, virtually every one of which involves computation with common fractions, some with quite large numerators and denominators, and concludes each with a more satisfied refrain such as: "and all is well" (*E sta bene*), "and it is done" (*Ed è fatta*), "and see how it turns out well" (*E echo che ttorna* [sic] *bene*).[23]

Soldi and *denari*

By the end of the fifteenth century Florentine architects had evidently even found common fractions to be so cumbersome when dealing with measurements denoted by all but the most ordinary fractions such as $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{8}$ that they adopted a new system of subdivision notably similar to serial fractions, but much easier to use.[24] In the new system, which was perhaps derived from the Roman monetary system (see, for example, the debt to Ugho above), one *braccio* is divided into 20 *soldi*, and each *soldo* is divided into 12 *denari*. Thus, the above-noted fraction $\frac{23}{24}$ in the new system is equivalent to 19 *soldi* and 2 *denari*, which by the late fifteenth century would have been written "s 19 d 2."[25] This system is both practical, because it renders any fractional quantity immediately comprehensible as some number of twenty parts plus-or-minus a little bit, and precise, because no fractional quantity is ever left out.[26]

The Venerable Model

The history of fractional arithmetic outlined above evidences a distinct development toward ever-increasing precision in thought and calculation during the late fourteenth and early fifteenth centuries. Thus, a customer who asked a merchant during the earlier part of this period for an eighth of a *braccio* of cloth represented a quite different attitude toward quantification than one who asked during the later part for a length of cloth measuring 2 *soldi* and 6 *denari* of a *braccio*, even though the two lengths are identical. Indeed, the earlier customer is not likely to have ever asked for, say, $\frac{23}{24}$ br of cloth, for he would have lacked both the conceptual tools with which to comprehend such a quantity, and the arithmetical vocabulary with which to request it; and if that were in fact the exact length needed, he is not likely to have been concerned with the difference between $\frac{23}{24}$ br of cloth and a full *braccio*, but more likely would have simply bought the full *braccio* and trimmed it down to suit his purpose. Thus for the earlier customer, $\frac{23}{24}$ br of cloth and a full *braccio* of cloth would have been, for all practical purposes, indistinguishable. More significant in the context of this study than the practical implications of the first attitude are the non-practical implications. The mental process of equating mathematically imperfect conditions, readily found in the real world, with imaginary idealized conditions facilitated a profoundly mystical interpretation of the world that may be considered one of the fundamental characteristics of western civilization before, and to an ever-decreasing extent during, the Renaissance.

Alfred W. Crosby, in his book *The Measure of Reality: Quantification and Western Society, 1250–1600*, elucidates this interpretation of medieval and Renaissance thought as follows:

> "Today we utilize numbers when we want narrow focus on a given subject and maximum precision in our deliberations. The old Europeans preferred broad focus and settled for imprecision in the hope of including as much as possible of what might be important. Often they were reaching not for a handle on material reality, but for a clue as to what lay beyond the scrim of reality. They were as poetic about numbers as about words."[27]

Crosby notes, for example, that Roger Bacon (c. 1221–c. 1292) readily equated a cycle in history of 693 years that he found in the writings of the Arabic astrologer Abu Ma'shar with the number 663, which he believed to be the number of the Antichrist. The correct number of the Beast of Revelation, Crosby notes, is 666 (Rev. 13:18), a discrepancy that perhaps arose because Bacon's copy of Revelation was defective. Crosby notes however, that:

> The other defect is more interesting. Abu Ma'shar's 693 and the Bible's 663 (or 666, if you want) are not the same number. [...] But Bacon believed that the message is more important than the vehicle, numbers. So he fudged the numbers, justifying himself by saying, "Scripture in many places takes something from a complete number, for this is the custom of Scripture" and "Perhaps God willed that this matter should not be explained fully, but should be somewhat veiled, like other matters which are written in the Apocalypse."[28]

Crosby traces the accelerated shift from this early attitude regarding quantification, which he calls the Venerable Model, after about 1250 to " […] the emerging New Model, [...] [which] was distinctive in its growing emphasis on precision, quantification of physical phenomena, and mathematics."[29] He thereby provides a far-reaching framework within which fundamental differences between medieval and later Renaissance thought can be productively characterized. In its emphasis on quantification, this framework is directly applicable to the study of medieval and Renaissance sets of architectural proportions.

Crosby's Venerable Model helps to explain medieval attitudes toward not only number but geometry. In September 1391 the mathematician Gabriele Stornaloco was summoned to the building site of the Cathedral of Milan to help resolve a problem involving both, and his solution is as remarkable for its mathematical precision as for its tolerance for geometrical and mathematical imprecision. The *capomaestro* at that moment, Annas de Firimburg, wanted the cross-section of the rising cathedral to conform to the proportions of an equilateral triangle. Since the foundations had already been laid with a width of 96 *braccia milanesi*, such a triangle would have an incommensurable height of 83.138… br. Annas and the building committee, however, evidently wanted the flexibility of easily divisible whole numbers. In a letter and accompanying diagram sent to the building committee, Stornaloco calculates a very close approximation of the height in question, which in modern notation comes out to 83.2 br, and describes it as "[…] somewhat less than 84 […]" (*aliquid minus de LXXXIIII*).[30] Stornaloco rounds up this height to 84 br and then divides it into six horizontal stages of 14 br each. That he continued to think of this vertically-stretched, formerly equilateral triangle as equivalent to a truly equilateral one is indicated by his diagram (elucidated by his accompanying verbal description), which consists of a single-line diagram of the cathedral cross-section, superimposed with a framework of diminishing equilateral triangles, all inscribed within an outer hexagon and circle.[31]

Thus, to paraphrase Crosby, for Stornaloco the message, equilateral triangle, is more important than the vehicle, a significantly compromised equilateral triangle. As a mathematician summoned to give expert advice on a major building project, Stornaloco may be assumed to represent the highest level of quantitative thinking of his time; and according to his way of thinking, an equilateral triangle 83.138… br tall, and another triangle of the same width but 84 br tall, could under some circumstances be considered identical. Thus, compared to this well-documented example of medieval willingness to ignore nearly 1 br *milanese* of difference between the heights of two triangles related to the Cathedral of Milan cross-section, the difference of just $\frac{1}{6}$ br *fiorentino* that I propose Talenti and his building committee ignored between the heights of two rectangles embedded in the Cathedral of Florence nave arcade bay thirty-four years earlier (Figure 5-19) represents a quite high level of design precision. By 1418, near-perfect precision would be achieved in Dolfini's San Lorenzo nave arcade bay set of proportions, where an overlapping square and root-2 rectangle, and their numerical dimensions $9\frac{2}{3}$ br and $13\frac{2}{3}$ br, all correspond within (in modern metric units) just 1-3 mm (Figure 4-12).[32]

Crosby's Venerable Model is akin to the medieval and Renaissance concept of *ordine*, which may be understood as both the image of God expressed in terms of geometry and number, and the antidote to that most dreaded state, disorder.[33] A building could be imbued with *ordine* through the use of sets of proportions employing culturally-valued numerical and geometrical constructs. Such constructs included, for example, not just any series of numbers or any four-sided figure, but numbers and geometrical figures that possessed certain culturally-recognized attributes such as symmetry, consistency, symbolism, and a name. Thus, an equilateral triangle—or if need be, an approximate one—possessed *ordine* whereas any randomly-selected triangle, even if symmetrical, would not. Similarly, to revisit the Santa Maria del Fiore example, a square-and-a-half and a two-square rectangle each possessed *ordine*, because they could be understood in terms of that perfectly symmetrical and individually named four-sided figure, the square, whereas the rectangle that would constitute the dimensional average of those two figures would not. Once these two figures were constructed to overlap precisely—with a little help from Venerable Model tolerance—they possessed even more *ordine* than they did individually (Figure 5-19).

In the centuries before the advent of modern structural engineering, architects relied on *ordine* to help ensure structural stability.[34] Buildings that possessed *ordine* thus became associated with stability and, in turn, with the unified attribute of *fortezza* and *bellezza* (strength and beauty). A letter of 1589 by the architect Francesco Terribilia pertaining to the completion of the late fourteenth-century basilica of San Petronio in Bologna, for example, explicates the structural benefits of an overall cross-section proportion that would make the basilica "[…] as high as it is wide […]" and thus conform to the proportions of a square. Terribilia notes that "[…] from this proportion is born a principal strength of the building […]". The letter goes on to attribute this strength to the properties of an implied circle: "[…] because if one places a circle in the middle of it [the basilica cross-section], drawing a circumference that touches the altar, and the walls at the sides, and the peak[s] of the vaults, one forms there a circle, embracing all three of the vaults together with the buttresses, that confers a very strong binding force throughout the work […]."[35]

Similarly, that medieval and Renaissance architects used the rotation of squares technique in part in the belief that it helped ensure structural stability is indicated in an anonymous passage inserted into the 1599 Venice edition (Italian translation) of *Margarita philosophica*, a popular and widely disseminated encyclopedic digest originally authored by Gregor Reisch.[36] According to both this anonymous passage and the today well-known medieval mason's manual published by Mathes Roriczer in 1486, the rotation of squares technique can be used to determine the proportions of vertical, multi-stage structures (such as a Gothic pinnacle, in Roriczer's example) by drawing three inscribed squares, the middle one rotated forty-five degrees, to determine the floor plan dimensions of each stage relative to the others.[37] The proportional ratio between the width of any two adjacent squares in such a series is $1{:}\sqrt{2}$. The largest square in the series is then taken as a module and multiplied some specified number of times for the height of the structure (seven in the case of Roriczer's pinnacle). While Roriczer is silent with regard to structural considerations, the anonymous encyclopedist notes, both verbally and with a diagram (Figure 6-2), that a height of six modules would be appropriate for the weight of stone, and that different multiples of the module are required depending on the weights of different materials.[38] Talenti thus perhaps made the Santa Maria del Fiore nave pier plinths 5 br square, and the foundation below them 7 br square on the belief that the ratio 5:7, which closely approximates the ratio $1{:}\sqrt{2}$ (which, of course, can be generated by the rotation of squares technique), would help ensure the structural stability of the nave arcades.[39]

Concluding Thoughts on the Crosby Thesis

The Crosby thesis serves as a valuable reminder that in the study of medieval sets of architectural proportions we must not hold the subjects of our study to New Model standards of quantitative precision if they were built under the influence of the Venerable Model. Thus, in the present study I propose that certain geometrical and numerical relationships in the Santa Maria del Fiore nave arcades constitute an intentional medieval set of proportions even though they contain notably less precision and consistency than do similar relationships in the San Lorenzo nave arcades.[40] Medieval culture changed during the approximately six decades that separate these two nave arcade designs. The quantitative criteria by which these nave arcade bay sets of proportions are judged therefore, must be adjusted accordingly as we search for evidence of geometrical and numerical intentions related to both the concept of *ordine*, and the unified concept of *fortezza* and *bellezza*.

Perhaps additional research into the sets of proportions found in other late medieval buildings will show that the notably greater precision of the San Lorenzo nave arcade bay sets of proportions compared to that of Santa Maria del Fiore represents one incremental step toward ever-increasing geometrical and arithmetical precision in medieval sets of proportions. Conversely, perhaps such research will show that the greater precision observed in the San Lorenzo nave arcades represents an abrupt leap forward such that the basilica deserves recognition as the first architectural expression of the New Model. Regardless of which of these interpretations eventually proves more accurate, the Crosby thesis provides a more promising framework for the study of medieval and Renaissance sets of architectural proportions than the Wittkower Paradigm.

Unlike the Crosby framework, the Wittkower Paradigm encourages unnecessary separation between our understanding of medieval architecture, and Renaissance architecture from the Basilica of San Lorenzo forward, and unecessary linkage between historical and aesthetic considerations in the study of sets of architectural proportions.[41] The eye cannot perceive intellectually satisfying numerical relationships such as $9\frac{2}{3} : 13\frac{2}{3}$, or 19, 29, 39, nor can it meaningfully distinguish between intellectually satisfying rectangles such as those derived from the square, and similar ones that are not. Thus, quite the opposite of the Wittkower Paradigm, historically accurate interpretations of sets of architectural proportions require *separation* of historical and aesthetic considerations, and *unification* of the periods we label medieval and Renaissance, such that these periods can be studied as one continuous, incrementally changing historical phenomenon.

Understood within this proposed new conceptual framework, the sets of proportions in the basilica of San Lorenzo cannot be understood as a “radical departure” from medieval precedent, but rather, as a logical development of it.[42] The set of proportions found in the Santa Maria del Fiore nave arcade bays may have provided Dolfini (or possibly Brunelleschi) with some of the seeds for that development; and the history of quantification now provides a useful framework within which to explore the methods and assumptions that accompanied that development from the mid-fourteenth to the early fifteenth centuries.

6.2 Sets of Proportions as Rhetorical Rather Than Aesthetic Structures

As noted in Chapter 1, an alternative to Wittkower’s aesthetic interpretation of architectural proportion (proportion-1 and proportion-3) is to interpret sets of proportions (proportion -3) as forms of communication that are incapable of producing aesthetically-significant visual outcomes. According to this new interpretation, sets of proportions can be understood as narratives that enhance the experience of architecture for those who are both capable of reading them and receptive to their messages. Understood as such, they belong to the rhetorical rather than the aesthetic or physical structures of architecture. While I propose here that historians can productively interpret sets of proportions as rhetorical devices however, I do not propose that medieval and Renaissance architects necessarily interpreted them that way.

Thus, while these architects appear to have recognized sets of proportions as rhetorical devices at least in some cases, such as when they incorporated number symbolism into architectural dimensions and quantities, in other cases they appear to have believed that sets of proportions served not merely to communicate through non-physical means, but to bring about *physical* outcomes that they considered to be both beautiful and structurally stable. Such beliefs held by medieval and Renaissance architects that could not possibly be true—at least, it is a premise of the present study that sets of proportions can bring about neither beauty nor structural stability in architecture—may also be considered rhetorical devices, in that they imbued architecture with meaning for those architects.

A medieval mason, for example, may have *believed* that a particular set of proportions caused a vault to be structurally stable, when in fact the stability of the vault depended most critically on a variety of other variables, such as the quality of the materials and the composition and mode of application of the mortar. The rhetorical interpretation of sets of proportions that I propose, furthermore, accommodates the possibility that at any given moment in history, medieval and Renaissance individuals may have held *diverse* beliefs with regard to sets of architectural proportions. This interpretation assumes, however, that virtually everyone who had some involvement with architecture during the periods in question, whether as designer, builder, patron or informed observer, held *some* beliefs with regard to them.

In Chapter 2, I suggested that Dolfini embraced a recognizably more intricate and theoretical approach to sets of architectural proportions than Brunelleschi. While Dolfini and Brunelleschi may have approached the problem of architectural proportion with different attitudes and intentions, however, both worked from a common foundation of medieval and Renaissance proportional belief that was characterized by a comprehensive notion of architectural correctness for which we have no equivalent today: A building that was di *proportione* (in correct proportion), possessed *ordine* (order), *fortezza* and *bellezza* (strength and beauty), and was right in every way.[43]

The concept of *ordine* was paramount in medieval and Renaissance thought, for the idea of a lack thereof, in a world ever threatened by war, corruption, famine, and disease; and haunted by the ubiquitous ruins of the once eminently orderly and powerful Roman Empire, was so utterly disagreeable.[44] Architecture was for these periods a permanent and reassuring symbol of humankind's perpetual quest for triumph over the forces of disorder. Indeed, Manetti describes the very origin of architecture as the process by which people first learned how to "expurgate disorder" (*purghare de' disordini*), and "discover order" (*scoprire qualche cosa di ragione*).[45] Thus the importance of *ordine* to the work of the architect could not be overstated in the medieval and Renaissance periods. Serlio accordingly excoriates those architects—though he would even deny them the honor of that title—whose buildings, wanting proportional order based on the principles of geometry, are merely "arbitrary and random" (*a ventura & a caso*).[46] Serlio laments the lack of art (*senza arte alcuna*) and order (*con pocca ragione*) in such works, using the words *arte* and *ragione*, respectively, and such words appear to be closely related to, if not synonymous with, the seemingly more common word *ordine*.[47] Even casual architectural criticism from these periods frequently refers to *ordine*, as in a late sixteenth century assessment of the church of San Petronio in Bologna that notes: "…it appears at first sight to be a beautiful work, and with some order…."[48]

The concept of *ordine* had more than merely symbolic import for the notion of architectural fitness in the medieval and Renaissance periods. Prior to the advent of modern structural analysis in the mid-eighteenth century, sets of proportions encoded a vast body of proto-engineering wisdom, hard-won through centuries of trial and error, that helped architects impose *certain kinds* of order in the hope of ensuring the structural stability of every part of a building, from foundations to vaults.[49] The repeated collapse of the immense dome of Hagia Sophia in the sixth, tenth, and fourteenth centuries, and of the soaring vaults of Beauvais Cathedral in 1284, are particularly spectacular examples of what must have been a continuous succession of structural failures in these periods.[50] Lorenz Lechler, in his booklet on Gothic design principles and techniques written for his son in 1516, acknowledges the inherent precariousness of both architecture and the architect's lot when he advises: "… if you give proper attention to my teaching, you can meet the needs of your building patron and yourself, and not be despised as the ignorant are, for an honorable work glorifies its master, if it stands up."[51]

In this climate of structural uncertainty, the proportions of buildings that stood up, and stayed up, came to represent strength (*fortezza*), and strength simultaneously came to embody beauty (*bellezza*), in a sense very different from our aesthetic understanding of the term today.[52] A building not only had to *be* strong but *look* strong to earn the confidence of those whose reputations depended on its structural stability, and perhaps of the general public as well. Thus, if the term *fortezza* came to mean "is strong," *bellezza* came to signify in part its essential complement, "looks strong." Thus, furthermore, did *bellezza* come to influence *fortezza*, as much as the inverse, for many a medieval and Renaissance building is structurally over-built for purely visual reasons, most notably when classical columns are involved.[53]

These two terms, which are subsidiary to the overarching concept of *ordine*, are often linked in the documentary record, sometimes accompanied by any of a host of other laudatory terms. Serlio's note that a particular set of antique pilasters "...uphold the corner by strength and with beauty of work" is typical, as is the late sixteenth century observation of architect Francesco Terribilia that the basilica of San Petronio in Bologna suffers "…some defects in its parts with regard to both strength and beauty."[54] Numerous variations on this theme can also be found in the documentary record. In the archives of the Cathedral of Florence, a newly proposed design for a column is described in 1357 as "more strong and beautiful and praiseworthy" than a previous one.[55] Another entry dated 1366 notes that various designs were evaluated to determine which "... is most beautiful and most useful and most secure.…"[56] In his late fifteenth century biography, Manetti notes that Brunelleschi completed the cupola of the Cathedral of Florence "... with very great beauty and strength and usefulness ...," and in 1587 a group of experts, including Terribilia, submitted a similarly worded opinion that the vault over the San Petronio nave "…must be made [in a way that provides] strength, beauty, and usefulness."[57]

The concept of *fortezza* and *bellezza* appears to be related to the canonical Vitruvian triad of architectural fitness—"strength, convenience, beauty"—which resembles the last three examples above.[58] It is also fundamental to Vitruvius's understanding of columnar proportions. Of the history of such proportions Vitruvius writes:

> "Wishing to set up columns in that temple, but not having rules for their symmetry, and being in search of some way by which they could render them fit to bear a load and also of a satisfactory beauty of appearance, they measured the imprint of a man's foot and compared this with his height…. Thus the Doric column, as used in buildings, began to exhibit the proportions, strength, and beauty of the body of a man."[59]

What, exactly, were the proportions that would imbue a work of architecture with *fortezza* and *bellezza*, and perhaps other attendant positive qualities? Extensive documentary evidence indicates that in the medieval and Renaissance periods, no one was ever quite sure. To determine the proportions of important structural members, Lechler simply advises his son: "Give attention to the divisions of the buttress; for that which is above the springer or capital you may take whatever you think will stand up well."[60] The equally candid remarks of the sixteenth century Spanish architect Rodrigo Gil de Hontañon, after his presentation of a rule for the estimation of rib vault thrusts, further convey a sense of how precarious it all was. Hontañon writes: "I have often attempted to rationalize the buttress needed for any bay, and have never found a rule adequate for me. I have also pursued the inquiry among Spanish and foreign architects, and none appears to have established a rule verified by other than his own judgment. Upon asking how we shall know whether such and such a buttress is enough, we are told that it is needed, but not for what reason. Some take the fourth [of the span], and others arrive [at an estimate] by certain orthogonals, and dare to have confidence…."[61]

<u>The Geometrical Model</u>

As the preceding evidence indicates, while medieval and Renaissance architects typically seem to have employed a great variety of numerical rules of thumb and geometrical techniques to determine the proportions of individual structural members, just as often they relied on simple guesswork.[62] To ensure overall stability, however, these architects appear to have believed that the presence of basic geometrical figures in the overall building proportions was necessary. Among the deliberations of the *Opera* of the Cathedral of Milan from the year 1400, for example, we find a proposal "...to integrate the aforesaid church and transept so that they correspond to a rectangle according to the demands of geometry, but beyond this, for the strength and beauty of the crossing-tower."[63] Similarly, a letter of 1589 by Terribilia pertaining to the completion of the basilica of San Petronio explicates the structural benefits of an overall cross-section proportion that would make the basilica "…as high as it is wide…," and thus conform to the proportions of a square, noting that "…from this proportion is born a principal strength of the building.…" The letter goes on to attribute this strength to the properties of an implied circle: "…because if one places a circle in the middle of it [the body of the basilica], drawing a circumference that touches the altar, and the walls at the sides, and the peak[s] of the vaults, one forms there a circle, embracing all three of the vaults together with the buttresses, that confers a very strong binding force throughout the work.…"[64]

In the absence of a scientific model for structural stability, the geometrical model described here must have seemed perfectly reasonable to medieval and Renaissance architects based on the evidence available to them, which would seem to have been everywhere apparent. A projectile launched upward at a forty-five degree angle, for example, flies farther than one launched with equal force at any other angle. Might not a vaulted bay proportioned according to the diagonal of a square (which has an angle of forty-five degrees), therefore, be stronger and last longer than one built to a different proportion? And if a bay proportioned as such indeed proved to be strong, would not imitating that proportion be a logical strategy for ensuring that another vaulted bay built elsewhere would also be strong? However logical the geometrical model might have seemed to the pre-modern mind however, when it led to successful results, which it must have done at least occasionally, it surely did so most often by accident. Other factors in addition to proportion, after all, such as types of foundations, strength of materials, extent and type of buttressing, and severity of wind loads are equally important in establishing structural stability in large buildings.

When a certain proportion appeared to result in structural stability, it earned the respect of architects and builders and remained in use until a better one was found. Indeed, just as pre-Copernican models of an earth-centered universe still find use among mariners today, so too does the geometrical model retain some limited relevance for architects and builders today.[65] For example, when a lintel above a window or door in a brick wall fails, modern science cannot predict the shape of the void that will result after the bricks above the opening have fallen out—a regular triangle of equilateral or somewhat lower proportions remains the best estimate.[66] Similarly, the root-2 rectangle happens to be a very efficient cross-section for a wood joist, ensuring near-maximum strength per unit of material for species of wood commonly used in construction.[67]

The necessity for structural stability in architecture, and the deeply-rooted belief in the efficacy of the geometrical model during the medieval and Renaissance periods, together help to explain the most notable similarity between the Dolfini- and Brunelleschi-designed proportions in the basilicas of San Lorenzo and Santo Spirito, that being the use of rectangular proportions based on the diagonal of the square for the proportions of large arched openings, or major portions thereof. The preceding evidence suggests that both architects may have understood such proportions to be useful conventions that would help to establish *ordine*, a condition that would also help to maintain architectural dimensions within the structural limits of masonry construction. Thus their works would not only remain standing, but would embody ample *fortezza* and *bellezza*. These geometrical proportions, perhaps in combination with various numerical and arithmetical relationships, could perhaps have carried other layers of significance for Dolfini and Brunelleschi involving number symbolism, and philosophical or religious beliefs, though additional research is needed to establish any such significance (and any differences between these two architects' belief systems) with certainty.[68] Without structural stability, however, there would be no architecture with which to associate such beliefs, and documentary evidence leaves little doubt that in the absence of modern structural engineering methods, geometrical sets of proportions constituted one important strategy that architects of Dolfini and Brunelleschi's day used with the intention of ensuring that their buildings would stand up and stay up.

The preceding analysis highlights the main purposes of sets of architectural proportions for people of the medieval and Renaissance periods: to provide *ordine* and the closely-related quality of structural stability. Architects and builders of these periods used sets of proportions of for a variety of other reasons as well, however, such as to ensure stylistic consistency, in particular where the classical orders were concerned, and to provide diagrammatic clarity, as in the logical subdivisions of floor plans (Figures 3-7 to 3-10). All of these purposes were significant for their narrative qualities, because they had no necessary, functional qualities. Sets of proportions, for example, did not ensure structural stability, and *ordine*, being an effect intended, but not always achieved, may have seemed necessary to some, but could not, in fact, have been necessary in any tangible way. While the columns of both the basilicas San Lorenzo and Santo Spirito, furthermore, appear to be equally correct examples of the Corinthian order, they have quite different proportions, those of Santo Spirito being about one capital height shorter than those of San Lorenzo, though the shaft diameters are equal. Thus, the columns of these two basilicas demonstrate that while sets of proportions can be used to create Corinthian columns that look correctly Corinthian, such sets are not necessary to produce such an outcome. Similarly, diagramatic clarity is not necessary for the function of a building, but has narrative value in leading the informed observer to understand a design as having originated from an earlier, more basic form, or at least to believe that it did (Figures 3-7 to 3-10).

Why medieval and Renaissance architects, including Dolfini and Brunelleschi, incorporated often-elaborate sets of proportions into the designs of their buildings when these sets do not appear to have been functionally necessary is a profound question that highlights the identity of architecture as an art, both in the fifteenth-century sense of *ars*, as the result of methodical, orderly reasoning, and in the modern sense, as a form of human expression.[69] This identity ultimately explains why the basilica of San Lorenzo has such a serene, orderly appearance that tends to make one think of geometry and mathematics. The basilica looks the way it does because Filippo Brunelleschi, the architect who is most responsible for its present appearance, wanted it to look that way, and had the skills as a designer and craftsman to bring his creative vision to fruition. Although the carefully-crafted sets of proportions that are incorporated into the dimensions of the basilica make no contribution to this aesthetic impression, those proportions communicates a wealth of information about early fifteenth-century knowledge pertaining to geometry, number, arithmetic, and perhaps more that future research will illuminate.

7.3 A Disciplinary Triad

The second characteristic of the Wittkower Paradigm that I identified in Chapter 1, suppression of the physical object in favor of documentary sources, is the product of a long philological tradition that Wittkower brought to architectural history from art history as a natural consequence of his training. Since I do not think that sets of proportion can be studied in the absence of the buildings in which they were embedded, I have made the object the focus of my study, not as an image to look at with the unaided eye and assess aesthetically, but as an object to measure and inspect at close range. In planning a study that uses the architectural object itself as a primary source of historical evidence, I found that architectural history offers a rich array of precedents, particularly in the areas of ancient and medieval studies.[70] I found few useful precedents, however, for the use of measurements in the study of architectural proportion.

The major document-based studies of proportion, though valuable, do not seek confirmation from measurements, and virtually all the measurement-based studies contain sufficient methodological shortcomings to have instilled deep skepticism in many architectural historians about the very viability of measurements as a source of historical evidence in the study of architectural proportion.[71] Contributing to this problem is the current lack of rigorous standards for observation-based research, such as those already in place for documentary research. For example, measurements are often cited without specifying the exact locations of all end points, the methods by which they were recorded, or by whom—essential information to enable the reader to understand and verify the data. I have developed my methodology with an eye toward addressing these challenges, aided by a rethinking of the nature of architectural history as a scholarly discipline.

Many architectural historians, particularly in North America, seem to view their discipline as a branch of art history, and perhaps as a consequence, much architectural history reads like art history—it tends to focus on those issues of greatest interest to art historians, such as style, ornament, iconography, aesthetics, patronage, and socio-cultural context; and to rely most often on the methods favored by them, namely documentary research, and to a lesser extent in contemporary scholarship, connoisseurship.[72] Yet I have found that viewing architectural history as a branch of *architecture*—as, let us say, architecture's alter-ego; the part that interprets rather than creates—has tended to focus my attention on other issues, of particular interest to architects, such as *parti* (diagrammatic intention), function, structure, dimension, spatial experience and transformation over time. This perspective has encouraged me to use in my own research the methods and techniques favored by architects today, such as measuring (Figures 6-3 and 6-4), drawing, model building, and structural analysis; for architecture, in its most fundamental operation of conceiving and placing a useful architectural object in the world, has not substantially changed since the time of Vitruvius.[73]

Such a reframing of architectural history as a branch of architecture places art history, with its relevant interests and methods, in a supportive role on one side and, by emphasizing the importance of the physical reality of building, places archaeology in a corresponding role on the other. With its unflinching devotion to the object, and its scientifically rigorous methods of observation, data collection, and analysis, archaeology has already contributed much to architectural history and could yet contribute more.[74] Thus, art history and archaeology as typcially practiced today have complementary strengths: art history favors interpretation through documentary research and formal analysis, keeping the object at a distance, if it is present at all; while archaeology favors quantitative analysis through direct and intensive observation of the object.

I like to think of architectural history, together with its companion architecture, as occupying a Lagrange Point equidistant between art history and archaeology, held there by the equal gravitational pulls of both. This triangular analogy has served as a useful reminder to integrate a variety of observation-based and documentary approaches into my San Lorenzo research. Thus, I have thought like an architect, in striving to reconcile theory with the practical realities of building; like an art historian, in comparing sculptural features throughout the building, and scouring the documentary evidence for insights into building history and intended proportional order; and like an archaeologist, in recording comprehensive measurements and other observations, and subjecting them to rigorous inductive analysis. In the end, however, I have crafted a unique approach to the study of architectural history unlike those of any of the above three disciplines.

Since the purpose of my research is the critical study of architectural proportion as historical evidence, and not the pure documentation of architectural form as an end in itself, nor the examination of human perception of architecture, the approach described here emulates scientific models of research, for hypotheses are rigorously formulated and tested, and empirical data is carefully controlled, but acknowledges the unpredictability of human nature that makes architecture one of the humanities. This integrated, observation-based approach to the study of architectural history has the potential to bring to light new knowledge pertaining not only to architectural proportion, but to many other areas of architectural theory and practice as well.[75]

[1] Wittkower, *Architectural Principles* cit., p. 161.

[2] Paul Tannery, *Memoires Scientifiques* 5 (Paris and Toulouse: E. Privat, 1922), 236.

[3] G.R. Evans, *From Abacus to Algorism: Theory and Practice in Medieval Arithmetic*, “The British Journal for the History of Science”, X, 35, 1977, pp. 114-115.

[4] D.J. Struik, *The Prohibition of the use of Arabic numerals in Florence*, “Archives internationales d’histoire des sciences” XXI, 84-85, 1968, pp. 291-294. Note that ‘Hindu-Arabic numeral’ is simply a more precise term for ‘Arabic numeral’. Selection of one or the other appears to be a matter of personal preference among scholars.

[5] *Ibidem*.

[6] W.W.R. Ball, *A Short Account of the History of Mathematics*, 3rd. ed., London, MacMillan and Co., 1901, p. 192.

[7] *Ibidem*, p. 193.

[8] See, for example, *Santa Maria del Fiore*, ed. by Guasti cit., p. 310, Doc. 462, dated February 9, 1411 (1412 new style), for Hindu-Arabic numerals; and *ibidem*, p. 310, Doc. 464, dated March 29, 1412, for Roman numerals. Cfr. mathematician Gabriele Stornaloco’s letter of 1391 that describes complicated calculations regarding the proportions of the Cathedral of Milan using Roman numerals. P. Frankl, *The Secret of the Mediaeval Masons*, “The Art Bulletin” XXVII, 1, 1945, p. 53. The most significant vehicles for the introduction of Hindu-Arabic numerals to the West appear to have been the Latin translation of Al-Khowarizmi’s *Arithmetic* in the twelfth century, Leonardo of Pisa’s *Liber abaci* of 1202 (revised 1228), and the numerous almanacs and calendars whose makers were early converts to the new system. G.R. Evans, *From Abacus to Algorism: Theory and Practice in Medieval Arithmetic*, “The British Journal for the History of Science” X, 35, 1977, p. 115; *A Source Book in Mathematics, 1200-1800*, ed. by D.J. Struik, Cambridge, Massachusetts, Havard University Press, 1969, p. 1; and W.W.R. Ball, *History of Mathematics* cit., pp. 192-193.

[9] F. Cajori, *A History of Mathematics*, New York and London, 1909, pp. 122-124; G.R. Evans, “From Abacus to Algorism: Theory and Practice in Medieval Arithmetic,” *The British Journal for the History of Science* 10, no. 35, 1977, p. 122.; L.C. Karpinski, *The History of Arithmetic*, New York, 1965, pp. 124-125; and K. Menninger, Zahlwort und Ziffer, Göttingen, Vandenhoeck and Ruprecht, 1958, Engl. transl. *Number Words and Number Symbols: A Cultural History of Numbers*, Cambridge, Massachusetts, The MIT Press, 1969, pp. 158-162. For the soureces of the symbols shown in Figure 7-1 see Gerbert, *Oeuvres de Gerbert, Pape sous le nom de Sylvestre II*, ed. by Alexandre Olleris, Paris, 1867, pp. 343-348 and 385-389; and *Due trattati inediti d’abaco, contenuti*

in due codici vaticani del secolo XII, ed. by Enrico Narducci, Roma, 1882, pp. 41 and 50 (republished extract from: "Bolletino di bibliografia e di storia delle scienze mathematiche e fisiche", XV, 1882, pp. 41-50);

[10] Evans, *From Abacus to Algorism* cit., p. 127.

[11] *Ibidem*, p. 122.

[12] *Santa Maria del Fiore*, ed. by Guasti cit., p. 66. Since the new year in the calendar used in Florence and many other regions of medieval and Renaissance Europe began on 15 March, any date notation between 1 January and 15 March must specify old style (new year on 15 March) or new style (new year on 1 January).

[13] From a document dated June 19, 1357. *Ibidem*, p. 94.

[14] A unit fraction is any fraction having a numerator of 1, or, 'unity'. In Egyptian mathematics, strings of unit fractions were added together to represent non-unit fractional quantities, since the only non-unit fraction that the Egyptians possessed was $\frac{2}{3}$. Thus, according to Karpinski, "seven-eighths was written as $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}$ or as $\frac{2}{3}, \frac{1}{8}, \frac{1}{12}$". Karpinski, *History of Arithmetic* cit., p. 121. Cf. D.E. Smith, *History of Mathematics*, II, New York, 1953, p. 209 ff. Serial fractions (my term), the various components of which are related to each other by more complex calculations than the simple addition in the Egyptian example above, have to my knowledge received scant attention in the history of mathematics literature. Karpinski simply refers to serial fractions as "[…] an Arabic device […]" that augmented "[…] the complications of unit fractions, common fractions, and sexagesimal fractions […]". He then proceeds to provide an example, marred by a typographical error, that should read as follows: "This Arabic device consisted in writing a fractional form $\frac{1}{3}\ \frac{1}{5}$ to mean $\frac{1}{3}+\frac{1}{5}$ of $\frac{1}{3}$ or $\frac{4}{13}\ \frac{3}{11}$ to mean $\frac{4}{13}+\frac{3}{11}$ of $\frac{1}{13}$". (The actual passage, before my correction, reads: "[…] fractional form $\frac{1}{3}\ \frac{1}{5}$ to mean $\frac{1}{3}+\frac{1}{3}$ of $\frac{1}{5}$ or […]"). Karpinski, *History of Arithmetic* cit., p. 126; and C.B. Boyer, *A History of Mathematics*, II ed., revised by U.C. Merzbach, New York, John Wiley & Sons, 1991, p. 255.

[15] The terms 'common', 'general', and 'vulgar' fraction all appear to be interchangeable references to any fraction with a numerator greater than 1, or 'unity'. Smith, *History of Mathematics*, II cit., pp. 213-219; and Karpinski, *History of Arithmetic* cit., p. 127.

[16] Note that elsewhere in the documents of the *Opera* of Santa Maria del Fiore, the fraction $\frac{1}{1}$, when used individually, appears to signify $\frac{1}{2}$ (see for example, *Santa Maria del Fiore*, ed. by Guasti cit., pp. 88, 96, 98, and 100). Such usage perhaps explains the above-noted scribe's confused verbalization of the number *xxxiij* $\frac{3}{8}\ \frac{1}{1}$. Occasionally it is used to signify "mid-" (*metà*), as in "mid-July" (*a* $\frac{1}{1}$ *lulglio* [*sic*]), and "mid-September" (*a* $\frac{1}{1}$ *settembre*) *Santa Maria del Fiore*, ed. by Guasti cit., pp. 93 and 102. In light of the evidence presented in this study, Saalman's note regarding the Santa Maria fel Fiore documents that "the fraction 1/1 throughout these documents stands for one-half" appears to be only partially correct. Saalman, *Santa Maria del Fiore* cit., p. 478.

[17] The document is dated February 9, 1411 (old style). *Santa Maria del Fiore*, ed. by Guasti cit., p. 310, Doc. 462. A subsequent document dated March 29, 1412 contains a Roman numeral, demonstrating the resilience of the old system. *Santa Maria del Fiore*, ed. by Guasti cit., p. 311 Doc. 464.

[18] *Santa Maria del Fiore*, ed. by Guasti cit., p. 310, Doc. 462.

[19] Paolo dell' Abbaco, *Trattato d'aritmetica, Secondo la lezione del Codice Magliabechiano XI, 86 della Biblioteca Nazionale di Firenze*, ed. by Gino Arrighi, Pisa, Domus Galilæana, 1964. Cfr. Cohen, *How Much Brunelleschi?* cit., p. 53 note 45.

[20] *Ibidem*.

[21] The shortcut is as follows: To derive a common fraction equivalent of a given serial fraction, first derive the denominator of the common fraction by multiplying together all the serial fraction denominators. Next, derive the numerator of the common fraction by multiplying the first serial fraction numerator by the second denominator, add the second numerator, and repeat to the end of the serial fraction. Thus, in Paolo's example the serial fraction $\frac{2}{3}\ \frac{1}{2}\ \frac{3}{4}$ is equivalent to the common fraction $\frac{23}{24}$. Paolo dell' Abbaco, *Trattato d'aritmetica* cit., p. 23, Problem 1. Note that many different combinations of serial fraction components can usually be found to denote one and the same common fraction.

[22] *Ibidem*.

[23] Paolo dell' Abbaco, *Trattato d'aritmetica* cit., pp. 25-26. Although serial fractions appear to have fallen out of common use after the fourteenth century, they appear to have survived in limited applications for centuries thereafter. In editions of Giovanni Branca's *Manuale d'architettura*

appearing as late as 1789, for example, a simplified, two-unit form of serial fraction is used in a chart comparing measurements from Rome and Modena. The Roman measurements are listed in whole numbers, while the Modena equivalents are listed as whole numbers plus fractions. Some of the latter fractions are common fractions with denominators of 16, such as $3\frac{8}{16}$ and $7\frac{15}{16}$. Others are serial fractions composed of a fraction with denominator 16, followed by $\frac{1}{2}$, for example, $3\,\frac{15}{16}\,\frac{1}{2}$ (equivalent to $3\frac{15}{16}+\frac{1}{32}$, or, $3\frac{31}{32}$), and $8\,\frac{13}{16}\,\frac{1}{2}$ (equivalent to $8\frac{13}{16}+\frac{1}{32}$, or, $8\frac{27}{32}$). In this form, unit fractions serve as a simple device for maintaining a maximum denominator of 16, perhaps because $\frac{1}{16}$ was a convenient minimum fractional unit for builders to be concerned with. Thus, in the first example, the builder would have known to measure $3\frac{15}{16}$, plus an additional $\frac{1}{32}$ of length, if he did not choose to simply drop that last $\frac{1}{32}$. Giovanni Branca, *Manuale d'architettura* III, iv, Modena, 1789, p. 64.

[24] Cfr. Cohen, "How Much Brunelleschi?" cit., p. 51, note 25.

[25] *Ibidem*, and Angelo Martini, *Manuale di metrologia*, Turin, 1883, p. 206.

[26] The fraction $\frac{1}{3}$ cannot be expressed in the modern metric system, for example, because 10 is not divisible by 3, and an endless decimal results; thus $\frac{1}{3}\text{ m} = 0.333\ldots\text{ m}$. One-third of an English foot, however, equals 4 inches (because the 12 inches in a foot are divisible by 3). Conversely, the fraction $\frac{1}{5}$, which equals 0.2 m in the metric system, cannot be expressed in terms of English inches because 12 is not divisible by 5. Since the *soldi* and *denari* system consists of two levels of subdivision, the first based on 20 units and the second on 12, all possible divisors can always be accommodated.

[27] A.W. Crosby, *The Measure of Reality: Quantification and Western Society, 1250–1600*, Cambridge, Cambridge University Press, 1997, pp. 46-47.

[28] Crosby, *The Measure of Reality* cit., pp. 121-122.

[29] *Ibidem*, 49, 58.

[30] J.S. Ackerman, "*Ars Sine Scientia Nihil Est*" *Gothic Theory of Architecture at the Cathedral of Milan*, "The Art Bulletin", XXXI, 2, 1949, pp. 89-90; and P. Frankl, *The Secret of the Medieval Masons*, "The Art Bulletin", XXVII, 1, 1945, 5. Guy Beaujouan's interpretation of Stornaloco's

calculations supersedes Panofsky's, though Beaujouan mistakenly indicates the height of the equilateral triangle in question as 83.136… instead of the correct height of 83.138…. *Ibidem*, pp. 61-64; and Guy Beaujouan, "Réflexions sur les rapports entre théorie et pratique au moyen âge," in *The Cultural Context of Medieval Learning*, ed. by J.E. Murdoch and E.D. Sylla, Dordrecht, Holland and Boston, D. Reidel Publishing Company, 1975, pp. 444-445.

[31] Ackerman, *Gothic Theory of Architecture* cit., pp. 89-90; and Shelby, *Secret*, 53-60.

[32] On the year 1418 as the *terminus ante quem* for the completion of the design of the San Lorenzo sets of proportions, see Cohen, *How Much Brunelleschi?* cit., pp. 41-42. The 1-3 mm discrepancy noted here is the difference between the height of an approximate root-2 rectangle that measures $9\frac{2}{3}$ br wide by $13\frac{2}{3}$ br high, and the height of a true root-2 rectangle that measures $9\frac{2}{3}$ br wide and ($\sqrt{2}$ x $9\frac{2}{3}$) br high.

[33] See Chapter 7.2.

[34] *Ibidem*.

[35] "Questa medesima altezza è proportionata col corpo principale della chiesa, perchè ella viene ad esser tant'alta quanto larga, dico lasciando le capelle che sono parte del corpo: et da questa proportione nasce una fortezza principale del edificio, perchè posto un centro nel meggio di essa, et tirata una circonferenza che tocchi l'ara et le mura dei lati et la cima delle volte, se ne forma un circolo, il quale abbracciando tutte tre quelle volte con li contraforti insieme viene a farsi una ligatura fortissima di tutta la fabrica. […] " G. Gaye, *Carteggio inedito d'artisti* III, Florence, Giuseppe Molini, 1840, p. 492.

[36] The passage appears in a chapter on architecture that does not appear in earlier editions. "Amaestramenti dell'architettura positive" in G. Reisch, *Margarita Philosophica*, Heidelberg, 1496, trad. it. *Margarita filosofica* […], Venice, Iacomo Antonio Somascho 1599, p. 999.

[37] See Figure 3-35.

[38] L.R. Shelby, *Gothic Design Techniques: The Fifteenth-Century Design Booklets of Mathes Roriczer and Hanns* Schmuttermayer, Carbondale, Illinois, Southern Illinois University Press, 1977, pp. 3–5, 32, and 84–87. The anonymous encyclopedist notes: "[…] various are the measures according to the material weighed. Thus different norms are used with stone, wood, and metal masses, one being heavier than the other. In stone, one square supports six of its equals in height, and these support six more smaller squares of a rotated arrangement, which result from the larger square, and proceeding thus, a pyramidal union is formed. " ("[…] diverse sono le misure secondo la

diversità del corpo ponderoso. Percioche altra norma si serva nei corpi di pietra, altra in quelli di legno, altra in quelli di metallo, essendo l'uno più grave dell'altro. In quelli di pietra un quadrato ne sostenta sei altri uguali a se in alto, & con questi altri sei minori quadrati di figura rivoltata, che risultano dal maggior quadrato, & cosi procedendo si fa una unione piramidale.") "Amaestramenti dell'architettura positive" in Reisch, *Margarita filosofica*, 1599 cit., p. 999. The appearance of this explication of the rotation of squares technique in a book published in 1599 should help lay to rest the widespread misconception among scholars that the rotation of squares technique was a medieval phenomenon that Renaissance architects did not use to any significant extent. Cfr. Cohen, "How Much Brunelleschi?" cit., pp. 24-27

[39] Likewise, Talenti may have believed that the 29 br by 41 br root-2 rectangle that he incorporated into the Santa Maria del Fiore nave arcade bay sets of proportions (Figure 6-20) contributed to the structural stability of the bay because, as a very close approximation of a root-2 rectangle, it too can be derived from the rotation of squares technique.

[40] Note, however, that the San Lorenzo overall basilica set of proportions, by contrast with the nave arcade bay set of proportions, embodies significant dimensional compromises. See Chapter 4.

[41] For passages in which Wittkower links sets of architectural proportions with aesthetics, see Chapter 1 and: *ibidem*, pp. ii, 116, 158-160; Idem, "Systems of Proportion," *Architects' Yearbook* 5, 1953, pp. 9, 16; and Idem, "Brunelleschi and 'Proportion in Perspective'," *Journal of the Warburg and Courtauld Institutes* 16, 3-4, 1953, pp. 132-134.

[42] Regarding the overall proportions of the basilica of San Lorenzo, Janson notes that Brunelleschi's "…clearly defined, separate space compartments represent a radical departure from the Gothic architect's way of thinking." H.W. Janson, *History of Art: a Survey of the Major Visual Arts from the Dawn of History to the Present Day*, II ed., Englewood Cliffs, New Jersey, 1977, p. 389; III ed., 1986, p. 409; and («radical change») VI ed., 2001, p. 397. In the current edition "radical" has been removed but the intent remains essentially unchanged: "[…] a new emphasis on symmetry and regularity distinguishes [Brunelleschi's] design for San Lorenzo [from Gothic precedents] […]." *Janson's History of Art: The Western Tradition*, VII ed. by Penelope J. E. Davies et al., Upper Saddle River, New Jersey, 2007, p. 513.

[43] See, for example, Giovanni di Domenico da Gaiole's letter of 1457 to Giovanni de' Medici, which contains the following description of Brunelleschi's unexecuted design for the crossing dome (*tribuna*) of San Lorenzo: "...it would have been less costly to dismantle and rebuild that *tribuna* in the manner of Filippo, which is light, strong, illuminated, and correctly proportioned, than to follow the unsatisfactory plan..." ("...gli era meno ispesa a disfare e rifare quella tribuna nel modo di filippo,

chè legiera, forte, alluminata e di proporzione, che seguire lo inconveniente...") Giovanni Gaye, *Carteggio inedito d'artisti dei secoli XIV, XV, XVI*, 3 vols. (Florence, 1839), 1:168. Sometimes this concept is expressed with the words *di ragione*, or *in sua ragione*, as in the following excerpt from Bernardo da Venezia's letter to the *opera* of the Cathedral of Milan, which employs an alternate spelling of this word: "…the body of the church would look more beautiful, and more in proportion…" ("…el corpo dela giesia parerave più bello, e più con sova rexone…"). James Ackerman, "'Ars Sine Scientia Nihil Est': Gothic Theory of Architecture at the Cathedral of Milan," *Art Bulletin* 31, no. 2 (June 1949), 95, 111. The preceding terms are comparable to the medieval German term *Gerechtigkeit* (or *gerechtikait*), which, as used by Mathes Roriczer, Shelby translates as "correctitude," or "correct design." Lon R. Shelby, *Gothic Design Techniques: The Fifteenth-Century Design Booklets of Mathes Roriczer and Hanns Schmuttermayer* (Carbondale and Edwardsville, Ill., 1977), 32-33, 106. A similar fifteenth century reference to this concept that is directly associated with Brunelleschi is found in the records of the Cathedral of Florence (the Basilica of Santa Maria del Fiore). In 1404 Brunelleschi sat on a board of advisors that oversaw the demolition and reconstruction of a then-newly completed portion of the tribune of Santa Maria del Fiore because the board believed it was built "at variance with the required and true measures." Frank D. Prager and Gustina Scaglia, *Brunelleschi: Studies of his Technology and Inventions* (Cambridge, Massachusetts: MIT Press, 1970) 16.

[44] For a fourteenth century expression of the fear of societal disorder, see Ambrogio Lorenzetti's fresco cycle, "The Allegories of Good Government and Bad Government," 1338-1339, Sala della Pace, Palazzo Pubblico, Siena. The association of order with goodness and virtue may be considered a fundamental concept of Western culture. See, for example, the Old Testament description of the Creation, and later representations thereof. Genesis, 1:2. For a typical example of a painted depiction of God the Geometer, c. 1250, see Ehrenfried Kluckert, "Romanesque Painting," in *Romanesque: Architecture, Sculpture, Painting*, ed. Rolf Toman (Cologne, 1997), 448.

[45] Antonio di Tuccio Manetti, *Vita di Filippo Brunelleschi*, ed. Giuliano Tanturli (Milan, 1976), 74-75.

[46] "The extent to which this most precise art of geometry is necessary to everyone can be testified by all those who at one time worked without it, but then later came to some understanding of the art; they will honestly confess that all the things that they thought and made without geometry were lacking in any art whatsoever, but were arbitrary and random. Since this most profound art of architecture is the embracer of many noble arts, firstly it is important that the architect be, if not learned, at least sufficiently emersed such that he has some understanding of it, particularly the

principles, and also more, and not like many consumers of stone, plaster and even marble, who today bear the name architect, but who do not even know what is a point, a line, a surface, or a body, or what correspondence and harmony are. But guided by their own opinions and what pleases their eyes, following the traces of others, which were made with little order (*ragione*), they go on working; and from this comes the disproportion and poor correspondence that one sees in many buildings….” (Quanto sia necessaria a qualunque persona la certissima arte della Geometria ne possono rendere testimonio tutti colloro che hanno un tempo operato senza quella, & dipoi son venuti in qualche cognition di tal’arte li quali veramente confessaranno, che tutte le cose da loro pensate & fatte senza Geometria, furono senza arte alcuna, ma a ventura & a caso. Per il che essendo la profundissima arte dell’Architettura abbracciatrice di molte arti nobili, primieramente fa di mistiero, che l’Architetto ne sia, se non dottato, almen tinto di forte ch’egli n’habbia qualche cognition, & massimamente de i principij, & anco piu avanti, & non come molti consumatori di pietre, & di calcine, imo de marmi, che al di d’hoggi tengono il nome di Architetti, liquali non sanno pur render conto che cosa sia punto, linea, superficie: o corpo, ne che sia corrispondentia, o harmonia. Ma guidati da un suo proprio parere, & complacentia d’occhio, seguitando le vestigie de glialtri, che con pocca ragione han fatto, vano operando, & di qui viene la disproportione e mala corrispondentia che in molti edificij si vede….) Sebastiano Serlio, *Il primo libro d’architettura*, (Paris, 1545), p. iii*v*.

[47] *Ibid.*

[48] “...si mostra in primo aspetto opera bella et con qualche ordine...” Francesco Terribilia, as quoted in Gaye, *Carteggio inedito d'artisti* (Florence, 1840), 3:491.

[49] According to Mainstone, “… the first recorded structural analysis of a building which is recognizably modern” dates to 1742. Rowland J. Mainstone, “Structural Theory and Design Before 1742,” *Architectural Review* 142, no. 854 (1968), 303.

[50] Although the great dome of Hagia Sophia collapsed repeatedly due to earthquakes, pier distortions had appeared soon after construction of the first dome in the sixth century. Robert Mark, *Light, Wind, and Structure: The Mystery of the Master Builders* (Cambridge, Mass., 1990), 77. On Beauvais Cathedral see: Mark, *Experiments in Gothic Structure* (Cambridge, Massachusetts: MIT Press, 1982), 58-77. See also Luca Pacioli’s lament that buildings often fall down because their builders use geometry without realizing that “everything consists of number, weight and measure.” Pacioli, *De divina proportione* (Venice, 1509), I:54, f. 16r, as quoted in Marcus Frings, “The Golden Section in Architectural Theory,” *Nexus Network Journal* 4, no. 1 (2002), 13.

[51] Lon R. Shelby and Robert Mark, "Late Gothic Structural Design in the 'Instructions' of Lorenz Lechler," *Architectura* 9.2 (1979), 115. Cf. the similar remark by Daniele Barbaro: "…one can well praise the effect of proportion, in which is placed the glory of the architect, and the strength of the work…" ("…ne si può lodare abastanza l'effetto della proportione, nella quale è posta la gloria dell'Architetto, la fermezza dell'opera…"), Barbaro, *I dieci libri dell architettura di M. Vitruvio…* (Venice, 1556), 24, as quoted in: Howard Saalman, "Early Renaissance Architectural Theory and Practice in Antonio Filarete's *Trattato di Architettura*," *Art Bulletin* 41, no. 1 (March 1959), 98 n. 24.

[52] For a general discussion of the development of modern conceptions of architectural beauty in the eighteenth century, see M.H. Abrams, "Art-as-Such: The Sociology of Modern Aesthetics."*Bulletin of the American Academy of Arts and Sciences* 38 (1985): 8-33. I thank K. Michael Hays for introducing me to this source. Wittkower's claim that "Italian architects strove for an easily perceptible ratio between length, height and depth of a building" reflects a post-eighteenth century interest in the purported perceptual effects of sets of architectural proportions that is inconsistent with the evidence presented in this study. Wittkower's statement is also ambiguous, for it does not explain what an "easily perceptible ratio" might be, compared to one that is not easily perceptible. Rudolf Wittkower, *Architectural Principles in the Age of Humanism* (New York, 1971), 74.

[53] Saalman refers to the concept of "*bellezza* and *fortezza*" as "the close theoretical interconnection of structural form and structural stability in mediaeval architecture…," and a "…nexus of form and statics, basic to an understanding of medieval architectural theory…." Saalman, "Early Renaissance Architectural Theory and Practice," 97. I prefer to refer to this concept as *fortezza* and *bellezza* in recognition of the order in which these related terms typically appear in relation to one another the primary sources.

[54] "... Fu fatto con buonissimo giudicio, perche et toglie ben su tutto quell' angolo e con fortezza, e con bellezza di opera...". Serlio, *Il Terzo Libro di Sabastiano Serlio Bolognese....* (Venice, 1540), LVIr. "... Patisca alcuni diffetti così nelle parti della fortezza come della bellezza..." Gaye, *Carteggio inedito d'artisti* (Florence, 1840), 3:491. In the documentary record this fundamental concept in the history of western architecture occasionally resurfaces as late as the nineteenth century, as in the following passage from Tredgold's builder's manual: "... when beauty and solidity are to be combined, the study of the higher branch of Architecture, which consists in the production of visible beauty, must, necessarily, be joined with the study of construction." Thomas Tredgold, *Elementary Principles of Carpentry* (London, 1828), vii–viii.

[55] "…la detta nuova colonna fatta per Franciescho essere più forte e bella e laudabile." Cesare Guasti, *Santa Maria del Fiore: La construzione della chiesa e del campanile* (Firenze, 1887), 103.

[56] "...gli pare più bello o più utile e più sichuro...." Guasti, *Santa Maria del Fiore*, 174. Cf. "...is most beautiful and most useful and strong..." ("...è più bello e più utile e forte..."), and a slight variation thereof, "...è più bello utile e più forte...," *ibid*.

[57] "...con grandissima bellezza e fortezza e comodi..." Manetti, *Vita*, 98; "...si debba fare per fortezza, bellezza e commodità...." Gaye, *Carteggio inedito* III (1840), 482. For additional Early Renaissance examples of the terms *fortezza* and *bellezza*, see Saalman, "Early Renaissance Architectural Theory and Practice," 97-98.

[58] "firmitatis, utilitatis, venustatis." Vitruvius, *De architectura*, I, iii, 2.

[59] "In ea aede cum voluissent columnas conlocare, non habentes symmetrias earum et quarentes quibus rationibus efficere possent, uti et ad onus ferendum essent idoneae et in aspectu probatam haberent venustatem, dimensi sunt virilis pedis vestigium et id retulerunt in altitudinem…. Ita dorica columna virilis corporis proportionem et firmitatem et venustatem in aedificiis praestare coepit." Vitruvius, *De architectura*, IV, I, 6.

[60] Shelby and Mark, "Late Gothic Structural Design," 120.

[61] "Probado he muchas veces a sacar razon del estribo que habra menester cualquiera forma y nunca hallo regla que me sea suficiente, y tambien lo he probado entre los arquitectos españoles y extranjeros, y ninguno paresce alcanzar verificada regla, mas de su solo albedrio; y preguntando por que sabremos ser aquello bastante estribo, se responde porque lo ha menester, mas no por que razon. Unos le dan el 1/4 y otros, por ciertas lineas ortogonales lo hacen y se osan encomendar a ello…," as quoted in George Kubler, "A Late Gothic Computation of Rib Vault Thrusts," *Gazette des Beaux-Arts* 26, series 6 (July-Dec. 1944), 146.

[62] Hontañon's reference to numerical rules of thumb in the determination of buttress proportions recalls similar rules of thumb mentioned in discussions recorded in the archives of the Cathedral of Milan. Jean Mignot, the French architect summoned by the cathedral building committee to help resolve certain important design issues, recommended a 1:3 ratio between the thickness of piers and buttresses, while the building committee countered with their own rule of 1:1 ½. *Ibid*.; and Ackerman, "'Ars Sine Scientia Nihil Est,'" 99. See Mainstone, "Structural Theory and Design Before 1742," p. 303, "geometrical theory."

[63] "...pro retificando praedictam ecclesiam et croxeriam quod respondent ad quatrangulum secundum ordinem geometriae; alia vero pro fortitudine et pulchritudine tiborii..." Ackerman, "'Ars Sine Scientia Nihil Est,'" 100, 109. Cf. the subsequent comment in the same passage: "…the weight on

these three (*sic*) towers falls evenly on their square, and they will be built properly and strong, and what is vertical cannot fall; therefore they say that they are strong in themselves….” (“…et quod pondus dictis tribus turribus ponderat ubique super suum quadrum, et erunt aedificata recte et fortiter, sed rectum non potest cadere; unde dicunt quod sunt fortes per se…”). *Ibid*., 100, 110.

[64] “Questa medesima altezza è proportionata col corpo principale della chiesa, perchè ella viene ad esser tant’alta quanto larga, dico lasciando le capelle che sono parte del corpo: et da questa proportione nasce una fortezza principale del edificio, perchè posto un centro nel meggio di essa, et tirata una circonferenza che tocchi l’ara et le mura dei lati et la cima delle volte, se ne forma un circolo, il quale abbracciando tutte tre quelle volte con li contraforti insieme viene a farsi una ligatura fortissima di tutta la fabrica.…” Gaye, *Carteggio inedito d’artisti* (Florence, 1840), 3:492. For sixteenth century drawings of the basilica of San Petronio cross-section with superimposed overlays of geometrical proportions, see Guido Zucchini, “Disegni inediti per S. Petronio di Bologna,” *Palladio* 6, no. 5-6 (1942), 153-166.

[65] For examples of earth-centric models, see Thomas Kuhn, *The Copernican Revolution* (Cambridge, Mass., 1976), 10-59.

[66] Even in the early twentieth century, rules of thumb based on idealized triangular shapes were still in circulation to cope with this problem, which has too many unpredictable variables for modern structural analysis to resolve. For determining the necessary strength of a lintel, for example, the author of a popular builder’s manual of 1921writes, alongside an illustration of a roughly triangular void caused by fallen brick above a rectangular opening: “Some authorities recommend considering as the proper load, for brick work, a TRIANGULAR PART [*sic*] of the wall the sides of which triangle have an inclination to the horizontal of 45°; others assume an inclination of 60°. The exact determination of this load by mechanical laws is difficult if not impossible. It is better to consider each case separately….” Frank E. Kidder, *The Architects’ and Builders’ Handbook*, 17th ed. (New York, 1921), 318.

[67] As confirmed by the author’s calculations under the supervision of Daniel Schodek. The root-2 rectangle, and its numerical approximations, is recommended as a useful rule-of-thumb for determining the strongest cross-section for a wood beam in builders’ manuals throughout the nineteenth and early twentieth centuries. For example, according to Kidder: “The <u>strongest</u> [sic] beam cut from a cylindrical log is one in which the breadth is to the depth as 5 is to 7, very nearly….” *Ibid*., 634. According to Gwilt, who cites Tredgold as his source, “…the <u>strongest</u> [sic] beam which can be cut out of a round tree is that of which the depth is to the breadth as √2 is to 1, or nearly 1.4142136 to 1; or as 7 to 5.” Joseph Gwilt, *The Encyclopedia of Architecture* (London,

1867), 433-434. Gwilt's own source, Tredgold's *Elementary Principles of Carpentry*, notes: "The strongest beam that can be cut out of a round tree is that of which the depth is to the breadth as the square root of 2 is to 1; or nearly as 7 is to 5." In a remarkable footnote to this passage, Tredgold notes: "This was first demonstrated by M. Parent in the 'Mémoires de l'Académie,' Paris, for 1708," thus linking this rule-of-thumb to a pre-1742 source. See note 6 and Thomas Tredgold, *Elementary Principles of Carpentry*, 8th ed. (1828; London, 1892), 74.

[68] See Cohen, "How Much Brunelleschi?," 43.

[69] I thank Caroline van Eck for calling my attention to the importance of the distinctions between *ars* and art. For further discussion of quattrocento ideas pertaining to science, *ars* and method see: Caroline van Eck, "The Structure of *De re aedificatoria* Reconsidered," Journal of the Society of Architectural Historians 57 (1998), 280-297.

[70] A few representative examples exhibiting various approaches include: Francis Cranmer Penrose, *An Investigation of the Principles of Athenian Architecture*.... (London, 1851); Walter Horn, "Romanesque Churches in Florence: A Study in their Chronology and Stylistic Development, *Art Bulletin* 25, no. 2 (Ju. 1943), 112-131; and Rowland Mainstone, *Hagia Sophia: Architecture, Structure and Liturgy of Justinian's Great Church* (New York, 1988).

[71] The exemplary document-based study of architectural proportion remains James S. Ackerman, "'Ars Sine Scientia Nihil Est': Gothic Theory of Architecture at the Cathedral of Milan," *Art Bulletin* 31, no. 2 (Ju. 1949), 84-111. In the same year appeared Wittkower's more ideological document-based study, *Architectural Principles in the Age of Humanism* (London, 1949). Note that Wittkower later adds a significant caveat to his assertion: "…Palladio's conception of architecture, as indeed that of all Renaissance architects, is based on commensurability of ratios" in the footnote: "The time for a reliable survey of Renaissance buildings has not yet come, but I feel confident that it would confirm my assumption." Rudolf Wittkower, *Architectural Principles in the Age of Humanism* (London, 1962), 108 and 108 n. 8 (and later editions). Regarding measurement-based studies of architectural proportion Ackerman has noted: "There exists among historians a conviction that it is dangerous to make conclusions from measurements that have no confirmation from the texts because of the unrigorous and/or inconsistent way in which virtually all of those who have published about proportions based on observation have proceeded." James S. Ackerman, in a personal letter to the author, 22 December 1991.

[72] For a useful definition of connoisseurship, see Eric Fernie, *Art History and Its Methods* (New York and London, 1995), 330-331. For an overview of the German contributions to the multiplicity of

viewpoints that have been accomodated under the umbrella of art history, see Michael Podro, *The Critical Historians of Art* (New Haven and London: Yale University Press, 1982).

[73] See the pertinent comments regarding the "architectural historian-architect" in Arnaldo Bruschi, "Problemi e metodi di ricerca storico-critica sulla architettura" in *Storia e restauro dell'architettura: proposte di metodo*, Gianfranco Spagnesi, ed. (Roma, 1984), 15-34. I thank Francesco Benelli for calling my attention to this source.

[74] Disciplinary relationships between architectural history and the related fields of architecture, art history and archaeology are complex and interwoven, and journals focused on the last three often carry articles pertaining to the first. Since 1996 the journal *Archeologia Medievale* has even produced an annual supplement called *Archeologia dell'Architettura*. Attitudes pertaining to these relationships, furthermore, vary from country to country. Undertaking archaeological surveys, or measured drawings (*rilievi*), for example, is a standard requirement in Italian architecture schools, but rare in American schools. See for example the series *Quaderni d'Architettura*, published by the *Dipartimento di Storia dell'Architettura, Restauro e Conservazione dei Beni Architettonici dell'Università "La Sapienza" di Roma*. On the history of Italian architecture schools see Maristela Casciato, "The Italian Mosaic: The Architect as Historian," *Journal of the Society of Architectural Historians* 62, no. 1 (Mar. 2003), 92-101. For recent discussions of interdisciplinarity in architectural history that tend to focus on disciplines other than those discussed here, see Nancy Steiber, "Learning from Interdisciplinarity," *Journal of the Society of Architectural Historians* 64 (2005), 417-418, and associated essays and references.

[75] One way in which this approach can lead to new insights in architectural history is through the intimate familiarity with the architectural built fabric that it enforces. Recording his surveys of the Parthenon, for example, Penrose observed not only optical refinements—his goal—but traces of an exuberant color scheme. Penrose, *Principles of Athenian Architecture*, 55. Similarly, while recording my surveys for the present study, I made numerous observations not directly related to architectural proportion, some of which are reported in Matthew Cohen, "The Bird Capitals of the Basilica of Santo Spirito in Florence: Some Observations, and a Proposed Iconographical Interpretation," *Quaderni del Dipartimento di Storia dell'Architettura e Restauro…di Firenze* 13-14 (Jan.–Dec. 1995), 48–58, but note that due to publication errors some photographs are misnumbered. A corrected version can be found at: http://www.spokane.wsu.edu/Academics/Design/CohenMatthew.

7. Epilogue: Proportional Aesthetic Mysticism

Many scholars today believe that particular sets of proportions enhance the aesthetic experience of architecture. I call this belief Proportional Aesthetic Mysticism (P.A.M.), and it is problematic because, as noted in Chapter 1, it directs scholarly attention towards the perceptions and aesthetic opinions of present-day observers rather than the thoughts and intentions of the architects in history who incorporated sets of proportions into the designs of the monuments of architectural history. It thus distracts architectural historians from the study of architectural history, and leads them into the areas of criticism and aesthetics. As I will argue below, furthermore, P.A.M. is illogical. Considering its wide influence, therefore, it calls into question the rigor of architectural history as a scholarly discipline.

Claude Perrault formally challenged the notion that architectural proportions (proportion-1) contribute to architectural beauty in the "Preface" to his *Ordonnance des cinq espèces de colonnes selon la méthode des anciens* of 1683 by arguing that "…in architecture there are, strictly speaking, no proportions that are true [*veritables*] in themselves…."[1] Thus, he argues, architectural proportions cannot be examples of what he terms "positive" beauty, or, that which is "bound to please everyone" due to its easily apprehended "value and quality."[2] Examples of positive beauty in architecture that he provides include richness of materials, size and magnificence, and precision and cleanness of execution.[3] Conversly, perceived beauty in architectural proportions, he argues, is always determined by "custom" and therefore constitutes a form of "arbitrary" beauty.[4] "For to be offended or pleased by architectural proportions…" he contends, "…requires the discipline of long familiarity with rules that are established by usage [i.e., custom] alone…."[5] Perrault's argument against any possible aesthetic benefits of particular architectural proportions (proportion-1) may be summarized in the following two points: 1) certain abstract proportions cannot contain a priori beauty while others do not; and 2) for a proportion to contribute to beauty in architecture it must be associated with favorable architectural forms, and therefore taste, and therefore custom.

Perrault's concept of positive beauty is confusingly similar to the proportional aesthetic belief system that he opposes, for one could use his notion of arbitrary beauty to argue that no positive beauty exists at all, but rather, that all beauty is arbitrary (i.e., determined by custom). Nevertheless, the second part of Perrault's argument, his notion of arbitrary beauty, remains a fundamental point of reference for consideration of this controversial topic today. Perrault provides insights into the widespread beliefs of his day pertaining to beauty and proportion, which were similar to widespread beliefs about this subject today, when he laments:

> "…most architects…would have us believe that what creates beauty in the Pantheon…is the proportion of that temple's wall thickness to its interior void, its width to its height, and a hundred other things that are imperceptible unless they are measured and that, even when they are perceptible, fail to assure us that any deviation from these proportions would have displeased us."[6]

Thus, he argues, that which creates beauty in the Pantheon cannot be merely a series of dimensional proportions. Perrault expresses his frustration with his fellow architects by noting that he would not even bother to address the issue of beauty in proportion had widespread opinion of his day not compelled him to. The preceding passage continues:

> "I would not linger unduly over this question…were it not for the fact that most architects hold the opposite opinion. This shows that we must not consider the problem unworthy of examination…even though reason appears to be on one side…."[7]

The purpose of Perrault's preface was to enable his primary readers, architects, to set aside their preconceptions regarding customary rules of proportion for the orders, and to consider receptively his proposed set of refinements to those rules. The purpose of the present epilogue, which elaborates upon Perrault's argument that only arbitrary beauty can guide perceived beauty in architectural proportions, is similar. By asking scholars to confront their preconceptions pertaining to assumed relationships between architectural proportions (proportion-1) and architectural aesthetics, I hope to facilitate new ways of exploring the uses of proportion (proportion-1 and proportion-3) in the history of architecture.

Why Sets of Proportions Cannot Contribute to Architectural Beauty

I have derived the following five contentions from my research into the sets of proportions of the basilicas of San Lorenzo and Santo Spirito, which included several months spent inside each of these buildings, looking at them from many different heights and locations. These contentions frequently overlap, and thus should be considered areas of emphasis rather than firm categories. Sets of proportions cannot logically contribute to beauty in architecture because:

<u>1. Sets of Proportions are mental, not visual, constructs.</u>

Sets of proportions can consist of intentional geometrical, numerical and arithmetical relationships.[8] The last two of these types of relationships are always invisible, and thus can only be described verbally. We cannot see, for example, how many units of measure (such as Florentine *braccia*) separate two columns, nor how many modules (such as column diameters) that distance is equivalent to, nor the arithmetical relationships that may link any group of dimensions (such as lengths of 9, 12 and 18 having a common divisor of 3). Thus Wittkower's claim: "I think it is not going too far to regard commensurability of measure as the nodal point of Renaissance aesthetics" has no visual relevance because commensurability of measure is not perceptible.[9] Numbers provide ways of talking and thinking about certain kinds of architectural proportions, but have no impact on architectural appearances.

Intentional geometrical proportional relationships influence the visible characteristics of architecture, as in, for example, an unadorned, rectangular opening in a wall, but the relationships themselves are not visible. Like numerical and arithmetical relationships, intentional geometrical proportions can only be precisely identified mentally, not visually. The façade of the basilica of Santa Maria Novella in Florence, for example, looks like it is composed of a series of squares and various 1:2 relationships as Wittkower claims it is (see Chapter 1). Careful measurement of the façade, however, is more likely to demonstrate that it consists of, depending on the points of measurement, a series of variously lopsided and distorted shapes, not quite squares and perhaps not quite even rectangles. We could choose to ignore such data and say "close enough," and describe these various shapes within the façade as named geometrical figures anyway, such as squares and whole-number-ratio rectangles, but such descriptions would be mental constructs, not visual observations. The very requirement that we need measurements in order to confirm or refute what we think we are seeing proves that geometrical proportional relationships are not visible in architecture. Furthermore, the absence in the architectural literature of any claims that the geometrical proportions of famous buildings consist of obscure geometrical proportions for which we have no names, such as, to take two random and obscure examples, a $3 : 3\frac{12}{17}$ rectangle, or a $5 \times 6 \times 6\frac{1}{3} \times 7$ trapezoid (and let us not even consider non-rectilinear buildings), proves that most observers are only interested in familiar, named geometrical figures. Since named figures cannot be distinguished from nameless ones with the unaided eye, their precise proportional characteristics must not be visible. These characteristics can only be apprehended mentally, just like numerical and arithmetical characteristics.

2. Architectural proportions do not exist in isolation of architecture.

Architectural proportions describe architectural forms, and thus cannot be isolated from the physical materials in which they are expressed. In architecture you can have a square window, but not a square. Thus, no one could ever prove that perceived beauty in a particular architectural composition were attributable to a particular proportional relationship rather than other aspects of an architectural design such as style and color, the effects of environmental phenomena such as light and shadow, optical illusions created by non-parallel or irregularly-intersecting lines, or the psychological and cultural predispositions of the observer.[10]

3. Proportions have no intrinsic beauty.

Even if architectural proportions could be isolated from architecture, as discussed in #2 above, no proportion or group of proportions could ever be proven to contain intrisic beauty, universally recognized by all people everywhere, always.[11] Tests of proportional aesthetic preferences that superficially emulate scientific research methods are inherently flawed because such preferences are subjective and thus resist quantitative analysis. For example, the very act of asking individuals in a test group to select the rectangles that they find most beautiful from an array of provided rectangular cutouts taints the results from the outset because it suggests to the individuals being tested that a rectangular cutout can be beautiful; and furthermore, because it assumes that the individuals' selections will indeed be determined by proportional assessments rather than other aesthetic considerations or associations, consciously or not.[12]

4. Sets of proportions rarely correspond precisely to built form.

Sets of proportions usually describe regular, symmetrical proportions based on straight lines and ninety-degree angles. Since complexity and irregularity are the normal conditions of architecture, however, the ideal relationships described by sets of proportions are rarely found in built works. The space between two columns may appear to be rectangular, for example, but since the sides of columns gently curve in entasis, and the profiles of capitals are usually much more complex, the shape of that space is in fact not rectangular but highly complex. In addition to such inherent design complexities, inherent irregularity caused by construction error, settlement, damage, intentional architectural refinements, and dimensional compromises that the architect may have been forced to accept for a great variety of reasons all make buildings unreliable platforms for the precise expression of sets of proportions. Furthermore, architectural proportions must be tied to specific points of measurement in the built fabric that do not necessarily correspond to visible edges of proportional figures. For example, if the distance between two columns were determined by a square proportion based on the column height (vertical dimension) and the on center distance (horizontal dimension), due to the thicknesses of the columns the eye would perceive a squarish, approximately rectangular space (it would not be truly rectangular, for the reasons noted above) between the column shafts, since the sides of the square proportional figure would be embedded in the centers of the columns.

Beauty-in-proportion believers typically dismiss such concerns by claiming that a close approximation of a particular proportion in built form can be as beautiful as an exact manifestation, a response that reveals the futility of attempting to apply logical reasoning to a discussion of the subjective and therefore inherently illogical topic of architectural aesthetics. Indeed, the preceding typical response (which I have heard numerous times in my conversations with beauty-in-proportion believers) raises the questions of how far a building can stray from some set of proportions that a believer has judged to be beautiful before the building ceases to be beautiful, and what kinds of deviations are allowable, and according to what criteria, and documented by what means; and for all of these questions, according to whose judgment? Believers, however, tend to shun such specifics as well, seeking shelter within the fog of ambiguous clichés such as “timeless architecture,” “harmonious proportions” and the most common one, “nevertheless, maybe there is something to it.”

<u>5. Proportions are fixed, while aesthetic judgment is capricious.</u>

Sets of proportions incorporated into the dimensions of a building are quantitative and essentially unchangable (some slight movement due to structural degredation nothwithstanding). Aesthetic judgements, by contrast, are qualitative, rarely unanimous among all people and always subject to change. Thus, the two are conceptually incompatible, cannot be studied using the same research tools, and cannot influence each other. While the presence or absence of certain proportions in a building can be established based on verifiable, scientific methods, the claim that sets of proportions contribute to architectural beauty can never be scientifically proven. Indeed, if it could be so proven, surely someone would have done so during the more than three centuries of debate over this belief since Perrault published the first serious challenge to it in 1683. The beauty-in-proportion belief system could never be definitively disproven either, however, since no problem involving the qualitative issue of aesthetic preferences could ever be defined in scientifically precise terms.

Since sets of proportions can be neither visually perceived nor visually isolated from architecture (except through the use of separate, drawn diagrams, which are thus isolated from architecture), have no intrinsic beauty, hardly ever correspond precisely to built form; and consist of fixed and measurable relationships of geometry, number and arithmetic, they cannot be the causes of subjective and potentially changeable assessments of visual beauty in architecture. If one nevertheless wanted to determine whether indeed they could be, a scientifically rigorous test for this purpose would be impossible to devise because sets ofproportions must be described in quantitative units, while opinions as to what is beautiful can only be described using the qualitative tools of verbal expression. One could argue that, aesthetic judgment being personal and subjective, the mere knowledge of the presence of certain proportions in a building causes some people to think of the building as beautiful. Such an effect, however, would be the result of psychological rather than physical causes. Furthermore, it would not occur in all people in all times, and thus could not be considered causal in the scientific sense of being repeatable and predictable.

It follows, therefore, that we cannot attribute dimensional qualities to an idea, except metaphorically; and likewise, that we cannot attribute the dimensional properties of a set of proportions to an assessment of beauty. Since a belief that is illogical, unprovable, and impossible to support with quantitative evidence cannot be based on reason, it must be based on faith. Since the beauty-in-proportion belief system lacks the institutionalized doctrines and customs of organized religion, I have labeled it as a type of mysticism: Proportional Aesthetic Mysticism.

[1] "…& que par consequent il n'y a point, à proprement parler, dans l'Architecture de proportions veritables en elles-mesmes [mêmes]…" Claude Perrault, *Ordonnance des cinq espèces de colonnes selon la méthode des anciens* (Paris: Jean Baptiste Coignard, 1683), xiv. Claude Perrault, *Ordonnance for the Five Kinds of Columns after the Method of the Ancients*, Julia Bloomfield, Kurt W. Forster and Thomas F. Reese, eds. and trans. (Santa Monica: Getty Center for the History of Art and the Humanities, 1993), 54. *Veritable* here refers to the possession of inherent, measurable qualities, independent of an observer; what Descartes and the British Epiricists would call primary qualities. I thank Caroline van Eck for clarification of this translation.

[2] "…j'appelle des beautez fondées sur des raisons convaincantes, celles par lesquelles les ouvrages doivent plaire à tout le monde, parce qu'il est aisé d'en connoistre [connaître] le merite & la valeur…." Perrault, *Ordonnance*, 1993, 50; and Perrault, *Ordonnance*, 1683, vi.

[3] Perrault, *Ordonnance*, 1683, v-vi.

[4] "Or j'oppose à ces sortes de beautez que j'appelle Positives & convaincantes, celles que jappelle Arbitraires, parce qu'elles dependent de la volonté qu'on a eu de donner une certaine proportion, une forme & une figure certaine aux choses qui pourroient en avoir une autre sans estre [être] difformes, & qui ne sont point renduës agreables par les raisons dont tout le monde est capable, mais seulement par l'accoûtumance…." *Ibid*., vii

[5] "…car pour estre [être] choqué, ou pour recevoir du plaisir des proportions de l'Architecture, il faut estre [être] instruit par une longue habitude des regles que le seul usage a établies…." *Ibid*., xiii.

[6] "C'est là pourtant ce que disent la plûpart des Architectes qui veulent qu'on croye que ce qui fait la beauté par exemple du Pantheon, est la proportion que l'épaisseur de ses murs a avec le vuide du Temple, celle que sa largeur a avec sa hauteur, & cent autres choses, dont on ne s'apperçoit point, si on ne les mesure; & par lesquelles, quand on s'en appercevroit, on ne seroit point asseuré qu'elles ne pussent estre [être] autrement sans déplaire." *Ibid*., v; and Perrault, *Ordonnance*, 1993, 49-50.

[7] "Je ne m'arresterois pas tant sur cette question…n'estoit que la plûpart des Architectes tiennent l'opinion contraire: Car cela fait voir qu'on ne doit point considerer ce Problême comme ne meritant pas d'estre [être] examiné…si la raison paroist estre [être] d'un costé [côté]…." Perrault, *Ordonnance*, 1683, v-vi; and Perrault, *Ordonnance*, 1993, 50.

[8] In this study numerical relationships are those that highlight the quantitative qualities of integers, such as number progressions; and arithmetical relationships are those that highlight calculations with numbers, such as a pair of numbers (whether whole or fractional) that approximate the ratio $1:\sqrt{2}$, and that can only be recognized as arithmetical by carrying out calculations. These definitions

sometimes overlap, such as, for example, when numbers that approximate the ratio 1:√2 occur in progressions (Figure 3-49). Since sets of proportions are interpreted in this study as modes of communication, the determination of whether a relationship is numerical or arithmetical depends upon the historian's interpretation of the architect's intention in selecting the relationship.

[9] Rudolf Wittkower, "Systems of Proportion," *Architect's Yearbook* 5 (1953), 16.

[10] Regarding the effects of optical illusions on the perception of architectural proportions see: Eugene Emmanuel Viollet-le-Duc, *Entretiens sur l'Architecture*, Paris, 1863, 2 vols., 1, "Septième entretien," 249-251; A. Thiersch, *Optisch Täuschungen auf dem Gebiete der Architektur*, Berlin, 1873, illustration sheet "Beispiele von Linientäuschungen." Geoffrey Scott, *The Architecture of Humanism*, London, New York and London, 1974 (rpt.1914), 170.

[11] This is, of course, Perrault's central argument. See note 2 above.

[12] Studies that attempt to determine, using scientific methodology, whether the golden section has universal aesthetic value, see: Gustav Theodor Fechner, *Zür experimentalen Aesthetik* (Leipzig: S. Hirzel), 1971; Idem, *Vorschule der Aesthetik* (Leipzig: Breitkopf & Härtel), 1876; C. Lalo, *L'esthétique experimentale contemporaine* (Paris: Alcan), 1908; Frank C. Davis, "Aesthetic Proportion," *American Journal of Psychology* 45 (April 1933), 298-302; LeRoy A. Stone, "The Golden Section Revisited: A Perimetric Explanation," *American Journal of Psychology* 78 (1965), 503-506; D.E. Berlyne, "The Golden Section and Hedonic Judgements of Rectangles: A Cross-Cultural Study," *Sciences de l'Art - Scientific Aesthetics* 7 (1970), 1-6; Michael Godkewitsch, "The 'Golden Section': An Artifact of Stimulus Range and Measure of Preference," *American Journal of Psychology* 87 (1974), 269-277; and John Benjafield, "The 'golden rectangle': Some new data," *American Journal of Psychology* 89, (1976), 737-743.

Appendices 8.1—8.3: Survey Methodology

The surveys of the basilica of San Lorenzo, the Old Sacristy, and the basilica of Santo Spirito, recorded by the author for this study, are the first comprehensive surveys of these structures ever published, and perhaps ever recorded.[1] The surveys are based on points of measurement that correspond to the edges of clearly articulated components of the classical orders and their subdivisions (points that usually correspond to the locations of masonry joints), those points being likely to indicate the dimensions that the various capomaestri and masons responsible for these buildings considered important. As a rule, these surveys include the mortar joint height with the element above it.

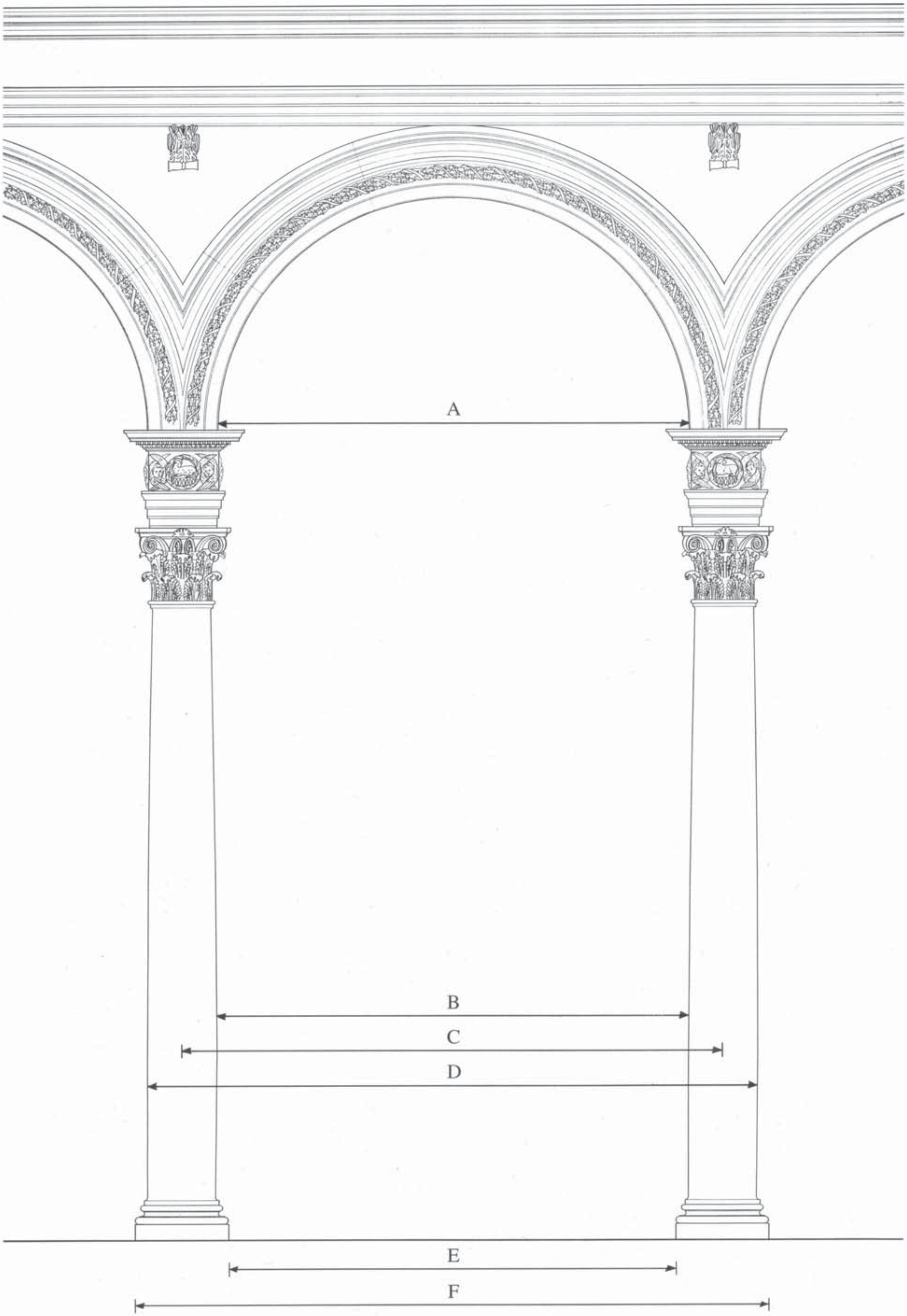
In order to minimize measurement error, the author worked alone whenever possible, using the simplest possible measuring techniques (Figure 36). Basic equipment consisted of steel tape measures manufactured by S.E.B., 80 cm levels, and a plumb line. For most vertical measurements, the zero end of the tape measure was secured to the floor at the edge of the column or pilaster plinth with a heavy weight. The measurement was then recorded from the scaffolding by projecting the desired point horizontally from the masonry surface to the tape measure, kept vertical with the plumb line. For upper entablature measurements, from the scaffolding the zero end of the tape measure was raised to the desired points with a specially adapted extendable pole, while an assistant recorded the measurements at the floor. The ceiling heights were measured in July 2005 with a Leica Disto A5 laser measuring device.

The surveys are organized into a system of key diagrams and spread sheets rather than traditional measured drawings, in order to make them easily retrievable and conducive to statistical analysis. The organization of each survey follows the compositional structure of the building it documents. The compositional structure of San Lorenzo is rather complex and requires some introduction. The basilica contains five types of vertical point supports (some of which are actually structural, and others merely expressions of structure). The minor order contains the nave columns and two types of pilasters, which I will term “floor pilasters” and “step pilasters.” The tops of all of these minor order members align with the lower entablature circumscribing the basilica (see Figure 25). The positions of the bottoms of these members vary, however. While the bases and plinths of the columns and floor pilasters stand on the nave floor, those of the step pilasters stand atop three steps (see Figures 1 and 25). Thus, the shafts of the step pilasters are approximately 1 br. shorter than those of the columns and floor pilasters. The major order contains the tall crossing pilasters, half of which are “floor crossing pilasters,” and the rest “step crossing pilasters.” The nave arcades contain only columns and floor pilasters. The nave arcade survey excerpted in Appendix 2 contains three sets of measurements: 1) San Lorenzo Nave Arcade Bay Horizontal Measurements (Intercolumniations),

2) San Lorenzo Column and Floor Pilaster Vertical Measurements, and 3) San Lorenzo Column and Floor Pilaster Horizontal Measurements. Key diagrams corresponding to these categories identify the various measurements recorded, and spread sheets contain the actual measurements.

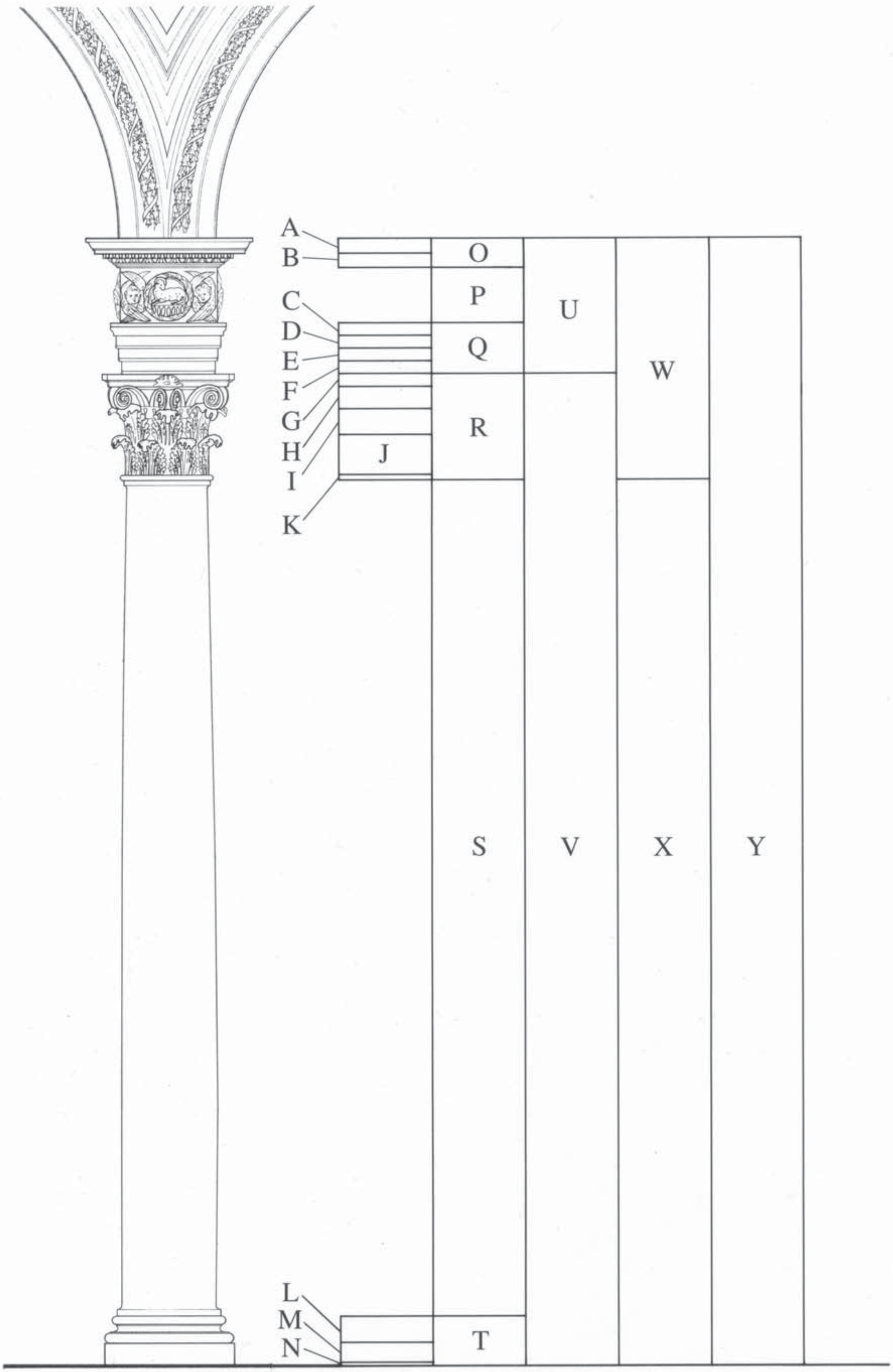
[1] The most extensive previously published surveys of these structures are those of Stegmann and Geymuller, Die Architektur der Renaissance in Toskana (Munich, 1885), I, 10-19, 27-35, which provide a scattering of measurements taken throughout each structure. The term "comprehensive" here refers to the inclusion of every repeated instance of a particular dimension, such as all nave column heights, rather than one representative dimension.

Appendix 8.1: San Lorenzo Survey



SAN LORENZO BAY WIDTHS

SAN LORENZO NAVE AND TRANSEPT BAY HORIZONTAL DIMENSIONS (INTERCOLUMNIATIONS)										
All measurements in cm										
NAVE SIDE AISLE, NORTH										
Bay Number:	**SP 65—SP 66**	**SP 66—SP 67**	**SP 67—SP 68**	**SP 68—SP 69**	**SP 69—SP 70**	**SP 70—SP 71**	**SP 71—SP 72**	**SP 72—SP 73**		
A. Arch Diameter	x	x	x	x	x	x	x	x		
B. In the Clear	621.8	595.0	590.9	592.2	591.5	591.8	597.0	x		
C. On Center	711.5	684.9	680.8	682.2	681.4	681.7	686.8	x		
D. In the Clear, Farther Shaft Surfaces	801.3	774.7	770.7	772.1	771.3	771.5	776.6	x		
E. Plinth to Plinth	595.0	569.0	567.3	569.0	567.2	567.5	571.5	572.5		
F. Plinth to Plinth, Farther Edges	828.0	800.7	794.3	795.3	795.5	795.8	802.0	x		
NAVE ARCADE, NORTH										
Bay Number:	**FP 7—8**	**8—9**	**9—10**	**10—11**	**11—12**	**12—13**	**13—14**	**14—FP 9**		
A. Arch Diameter	x	x	x	x	x	x	x	x		
B. In the Clear	590.7	594.7	593.4	596.4	595.8	594.8	595.8	603.6		
C. On Center	x	680.9	680.8	682.3	681.7	681.4	683.0	x		
D. In the Clear, Farther Shaft Surfaces	x	767.1	768.1	768.2	767.6	768.1	770.2	x		
E. Plinth to Plinth	563.5	564.0	564.0	566.2	566.3	565.5	566.2	575.7		
F. Plinth to Plinth, Farther Edges	x	797.7	797.5	798.3	797.1	797.3	799.8	x		
TRANSEPT										
Bay Number:	**FP 5—SP 10**	**SP 12—SP 15**	**SP 17—SP 23**	**SP 25—SP 28**	**SP 30—SP 33**	**SP 42—SP 45**	**SP 47—SP 50**	**SP 52—SP 58**	**SP 60—SP 63**	**SP 65—FP 6**
A. Arch Diameter	x	x	x	x	x	x	x	x	x	x
B. In the Clear	x	x	588.2	x	x	x	x	584.7	x	x
C. On Center	x	x	677.8	x	x	x	x	674.2	x	x
D. In the Clear, Farther Shaft Surfaces	x	x	767.5	x	x	x	x	763.6	x	x
E. Plinth to Plinth	533.9	550.5	560.7	551.0	550.3	540.5	546.8	557.5	545.2	531.6
F. Plinth to Plinth, Farther Edges	x	x	794.8	x	x	x	x	790.8	x	x
NAVE ARCADE, SOUTH										
Bay Number:	**FP 4—7**	**7—6**	**6—5**	**5—4**	**4—3**	**3—2**	**2—1**	**1—FP 2**		
A. Arch Diameter	x	x	x	x	x	x	x	x		
B. In the Clear	591.2	593.4	594.1	593.9	594.6	594.6	594.3	605.9		
C. On Center	x	680.9	681.2	681.3	681.6	681.5	681.3	x		
D. In the Clear, Farther Shaft Surfaces	x	768.5	768.3	768.6	768.6	768.3	768.3	x		
E. Plinth to Plinth	563.2	564.2	564.4	564.3	564.5	564.5	565.1	577.8		
F. Plinth to Plinth, Farther Edges	x	797.6	797.9	798.2	798.6	798.4	797.5	x		
NAVE SIDE AISLE, SOUTH										
Bay Number:	**SP 10—SP 9**	**SP 9—SP 8**	**SP 8—SP 7**	**SP 7—SP 6**	**SP 6—SP 5**	**SP 5—SP 4**	**SP 4—SP 3**	**SP 3—SP 2**		
A. Arch Diameter	x	x	x	x	x	x	x	x		
B. In the Clear	620.1	590.1	591.6	592.1	591.0	591.4	597.7	x		
C. On Center	709.6	679.6	681.2	681.8	680.8	681.0	687.2	x		
D. In the Clear, Farther Shaft Surfaces	799.1	769.1	770.8	771.6	770.5	770.7	776.7	x		
E. Plinth to Plinth	592.7	562.8	564.5	566.0	565.5	565.7	572.0	576.8		
F. Plinth to Plinth, Farther Edges	826.5	796.3	797.8	797.6	796.0	796.3	802.4	x		



SAN LORENZO COLUMN/ FLOOR PILASTER VERTICAL DIMENSIONS

SAN LORENZO COLUMN AND FLOOR PILASTER VERTICAL DIMENSIONS

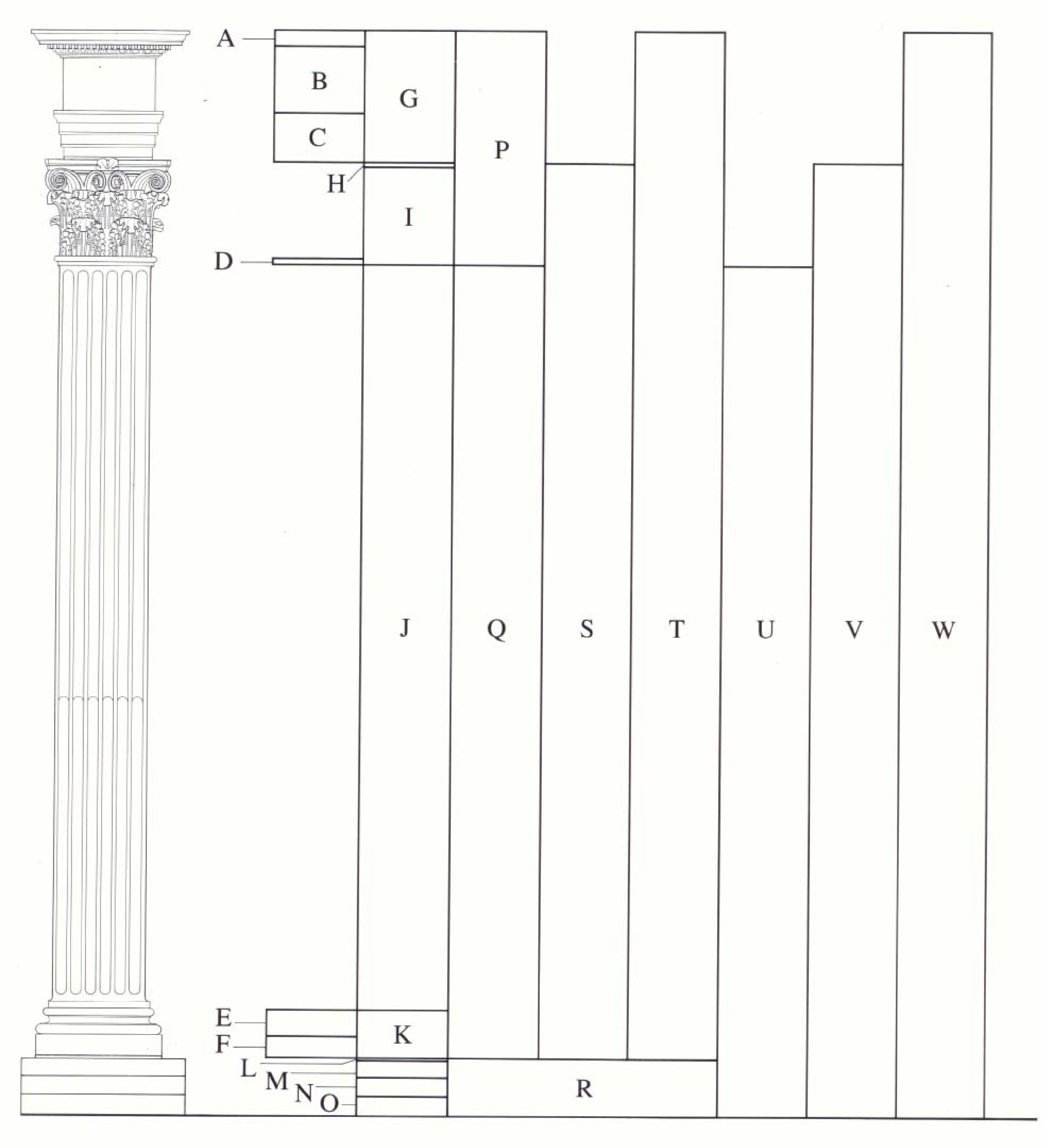
All measurements in cm

NAVE ARCADE, NORTH

Column and Floor Pilaster Number:	FP 7	COL 8	COL 9	COL 10	COL 11	COL 12	COL 13	COL 14	FP 9	FP 6
A. Cornice Upper Projection	14.9	14.4	14.7	14.9	14.6	13.3	14.4	14.5	14.5	15.1
B. Cornice Crown Molding	13.3	13.6	13.1	12.9	13.3	13.1	12.4	12.7	13.0	13.8
C. Architrave (fascia 4)	11.5	11.4	11.4	11.5	11.8	11.5	11.5	11.6	11.4	11.6
D. Architrave (fascia 3)	11.6	11.4	11.5	11.5	11.2	11.4	11.4	11.5	11.5	11.5
E. Architrave (fascia 2)	11.7	11.4	11.4	11.4	11.7	11.3	11.6	11.7	11.4	11.4
F. Architrave (fascia 1)	11.5	11.6	11.7	11.7	7.4	11.6	11.7	10.5	11.9	11.3
G. Abacus	11.0	10.0	10.3	11.5	10.9	10.5	12.7	12.2	10.1	11.2
H. Volute	18.1	21.1	20.3	19.4	18.8	19.5	21.7	19.3	20.8	21.0
I. Acanthus Leaf (upper)	28.0	28.3	28.8	26.8	31.6	31.3	25.8	31.1	26.1	27.6
J. Acanthus Leaf (lower)	32.0	31.9	32.5	33.8	32.8	34.3	31.9	31.8	34.0	33.3
K. Astragal	4.7	5.2	5.1	5.3	4.1	4.5	5.7	5.7	5.1	5.2
L. Base	25.2	25.1	24.9	25.1	22.8	23.8	25.9	24.9	24.5	25.6
M. Plinth	18.8	19.7	19.8	19.1	16.6	17.1	17.8	17.5	16.6	19.0
N. Raised Foundation	0	0.3	0	0.4	0	3.1	4.3	0.9	0	0
O. Cornice	28.2	27.9	27.8	27.8	28.0	26.3	26.8	27.2	27.5	28.9
P. Frieze	49.8	49.7	49.8	50.0	49.6	49.4	49.4	49.5	52.0	49.7
Q. Architrave	45.3	45.6	45.7	45.8	41.6	45.9	45.9	44.5	46.2	45.5
R. Capital (including astragal)	97.7	96.6	96.8	96.4	98.0	96.9	96.9	99.6	95.4	97.4
S. Shaft (excluding astragal)	763.5	763.0	764.8	765.0	773.2	765.8	772.5	770.1	766.4	763.4
T. Base + Plinth + Raised Foundation	44.0	45.1	44.6	44.5	39.4	44.0	48.0	43.3	41.1	44.6
U. Entablature Block	123.5	123.4	123.5	123.6	119.4	122.0	122.4	121.5	125.5	124.1
V. Column	905.2	904.6	906.2	905.8	910.6	906.6	917.4	912.9	902.9	905.4
W. Entablature Block + Capital	221.2	219.9	220.3	220.0	217.4	218.9	219.3	221.1	220.9	221.5
X. Shaft (to floor, excluding astragal)	807.5	808.0	809.4	809.5	812.6	809.7	820.5	813.3	807.5	808.0
Y. Total Order	1028.7	1027.9	1029.7	1029.5	1030.0	1028.6	1039.8	1034.4	1028.4	1029.5

NAVE ARCADE, SOUTH

Column and Floor Pilaster Number:	FP 4	COL 7	COL 6	COL 5	COL 4	COL 3	COL2	COL1	FP 2	FP 5
A. Cornice Upper Projection	15.1	14.7	14.8	14.2	14.6	14.6	14.7	14.7	14.4	15.1
B. Cornice Crown Molding	13.4	13.3	13.2	13.4	13.6	13.0	13.2	12.9	12.8	13.5
C. Architrave (fascia 4)	11.5	11.4	11.5	11.4	11.8	9.9	12.2	12.4	11.2	11.5
D. Architrave (fascia 3)	11.3	11.5	11.5	11.3	11.8	11.9	12.0	12.3	11.2	11.6
E. Architrave (fascia 2)	11.8	11.5	11.5	11.3	12.1	11.6	12.0	11.9	11.7	11.5
F. Architrave (fascia 1)	12.0	11.7	11.7	12.0	10.1	12.8	10.2	9.9	11.6	11.5
G. Abacus	10.6	11.4	11.4	10.2	12.0	12.5	11.5	11.7	11.5	10.2
H. Volute	20.5	19.3	21.0	20.8	24.4	21.6	21.7	19.1	23.5	19.5
I. Acanthus Leaf (upper)	30.0	27.8	28.0	27.3	23.5	26.5	29.3	31.3	24.5	32.0
J. Acanthus Leaf (lower)	31.0	33.3	31.3	33.2	32.8	32.5	29.6	30.9	33.1	30.6
K. Astragal	5.1	5.3	5.2	5.5	4.9	4.4	4.9	4.6	5.2	5.3
L. Base	22.0	25.0	25.0	25.2	24.8	25.0	24.6	24.5	24.2	25.5
M. Plinth	19.2	19.6	19.8	19.3	19.2	18.6	19.2	15.5	16.7	19.0
N. Raised Foundation	0	0	0	0.5	0.3	0.9	0	0.8	0.3	0
O. Cornice	28.5	27.9	28.0	27.6	28.2	27.6	27.9	27.6	27.2	28.6
P. Frieze	49.7	49.8	50.1	50.3	50.3	50.9	50.2	50.3	49.5	49.8
Q. Architrave	46.0	45.6	45.8	45.8	45.6	45.8	45.8	45.9	45.8	45.7
R. Capital (including astragal)	96.8	96.8	96.5	96.8	97.1	96.8	97.0	97.1	96.3	97.6
S. Shaft (excluding astragal)	767.3	764.8	764.1	764.4	762.6	763.7	764.0	768.8	767.3	763.5
T. Base + Plinth + Raised Foundation	41.2	44.6	44.8	45.0	44.3	44.4	43.8	40.8	41.2	44.5
U. Entablature Block	124.3	123.7	124.0	123.7	124.0	124.4	124.0	123.8	122.5	124.1
V. Column	905.3	906.1	905.3	906.2	903.9	904.9	904.8	906.6	904.8	905.6
W. Entablature Block + Capital	221.1	220.5	220.5	220.6	221.0	221.1	221.0	220.9	218.8	221.7
X. Shaft (to floor, excluding astragal)	808.5	809.3	808.9	809.4	806.8	808.2	807.8	809.6	808.5	808.0
Y. Total Order	1029.6	1029.8	1029.3	1029.9	1027.8	1029.3	1028.8	1030.5	1027.3	1029.7



San Lorenzo Step Pilaster Vertical Dimensions

SAN LORENZO STEP PILASTER VERTICAL DIMENSIONS

All measurements in cm

NAVE SIDE AISLE, NORTH

Step Pilaster Number:	SP 65	SP 66	SP 67	SP 68	SP 69	SP 70	SP 71	SP 72	SP 73	SP 74
A. Cornice (not including crown molding)	x	x	x	x	x	x	x	x	x	x
B. Frieze + Crown Molding	x	x	x	x	x	x	x	x	x	x
C. Architrave	42.3	46.3	45.4	44.6	45.7	44.3	45.5	46.1	x	x
D. Astragal	4.8	6.0	4.6	6.0	6.0	6.3	6.0	5.5	x	x
E. Base	25.5	25.6	26	25.7	25.8	26.5	26.2	25.7	27.4	27.3
F. Plinth	19.5	17.0	17.4	17.5	16.5	17.2	18.4	17.0	15.1	15.4
G. Entablature	120.3	126	124.2	125.4	124.5	124.3	127.2	126.6	x	x
H. Gap	-1.5	3.0	0	6.3	0	0	0	5.7	0	0
I. Capital (including astragal)	97.7	108.3	102.2	95.1	102.3	99.3	97.3	95.7	x	x
J. Shaft	704.7	698.7	708	708.3	706.2	708.9	706.9	705.8	x	x
K. Base + Plinth	45.0	42.6	43.4	43.2	42.3	43.7	44.6	42.7	42.5	42.6
L. Raised Foundation	0	0	0	0	0	0	0	0	0	0
M. Third Step	20.7	17.6	16.7	17.6	17.5	17.0	16.0	16.8	18.1	18.1
N. Second Step	17.7	17.4	16.5	17.0	16.5	17.0	17.0	16.7	16.9	17.0
O. First Step	21.5	17.5	17.5	17.5	17.8	17.1	17.0	16.8	16.2	16.1
P. Capital + Entablature	218.0	234.3	226.4	220.5	226.8	223.6	224.5	222.3	x	x
Q. Shaft + Base + Plinth	749.7	741.3	751.4	751.5	748.5	752.6	751.5	748.5	x	x
R. Steps + Raised Foundation	59.5	51.5	50.7	51.5	51.5	49.0	49.8	49.0	50.3	51.0
S. Step Plaster	847.4	849.6	853.6	846.6	850.8	851.9	848.8	844.2	x	x
T. Total Order Height	967.7	975.6	977.8	972.0	975.3	976.2	976.0	970.8	x	x
U. Shaft Height to Floor	809.2	792.8	802.1	803.0	800.0	801.6	801.3	797.5	x	x
V. Step Pilaster + Steps	906.9	901.1	904.3	898.1	902.3	900.9	898.6	893.2	x	x
W. Total Order Height to Floor	1027.2	1027.1	1028.5	1023.5	1026.8	1025.2	1025.8	1019.8	x	x

TRANSEPT, NORTH

Step Pilaster Number:	SP 42	SP 45	SP 46	SP 47	SP 50	SP 51	SP 52	SP 54	SP 57	SP 58	SP 59	SP 60	SP 63	SP 64
A. Cornice (not including crown molding)	28.5	27.5	27.5	29.0	29.1	22.7	27.4	28.8	28.0	25.9	26.5	29.5	29.0	29.3
B. Frieze + Crown Molding	51.5	50.5	50.6	49.7	46.8	54.2	50.1	47.6	51.1	51.2	52.2	49.1	49.7	50.0
C. Architrave	45.0	44.8	45.2	44.9	45.0	44.6	45.0	45.2	46.9	45.5	47.0	44.2	41.6	42.5
D. Astragal	6.4	6.5	5.4	5.6	6.2	5.8	4.0	4.4	4.8	4.5	5.3	5.4	5.7	4.9
E. Base	25.2	25.3	25.3	25.2	25.2	25.0	25.1	25.2	24.4	25.0	24.7	25.1	25.5	25.5
F. Plinth	15.4	19.5	19.5	19.0	19.5	19.3	19.4	20.7	20.5	19.5	19.3	19.4	20.0	19.3
G. Entablature	125.0	122.8	123.3	123.6	120.9	121.5	122.5	121.6	126.0	122.6	125.7	122.8	120.3	121.8
H. Gap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I. Capital (including astragal)	97.7	97.7	97.6	98.3	98.1	97.2	96.5	96.9	95.8	96.0	95.8	99.6	99.2	97.2
J. Shaft	705.6	705.3	705.4	704.5	707.2	705.4	704.5	704.3	703.4	705.3	703.4	704.9	704.1	704.9
K. Base + Plinth	40.7	44.6	44.5	44.3	44.6	44.5	45.0	45.9	44.9	44.7	44.1	44.3	45.4	44.8
L. Raised Foundation	0	2.1	0	0	0	0	0	0	0	0	0	0	0	0
M. Third Step	x	x	19.0	x	x	18.6	x	x	x	x	16.5	x	x	19.5
N. Second Step	x	x	18.0	x	x	17.9	x	x	x	x	18.2	x	x	19.1
O. First Step	x	x	17.5	x	x	18.4	x	x	x	x	19.5	x	x	20.1
P. Capital + Entablature	222.7	220.5	220.9	221.9	219.0	218.7	219.0	218.5	221.8	218.6	221.5	222.4	219.5	219.0
Q. Shaft + Base + Plinth	746.3	749.9	749.9	748.8	751.8	749.9	749.5	750.2	748.3	750.0	747.5	749.2	749.5	749.7
R. Steps + Raised Foundation	x	x	54.3	x	x	54.9	x	x	x	x	54.1	x	x	57.8
S. Step Plaster	844.0	847.6	847.5	847.1	849.9	847.1	846.0	847.1	844.1	846.0	843.3	848.8	848.7	846.9
T. Total Order Height	969.0	970.4	970.8	970.7	970.8	968.6	968.5	968.7	970.1	968.6	969.0	971.6	969.0	968.7
U. Shaft Height to Floor	x	x	804.2	x	x	804.8	x	x	x	x	801.6	x	x	807.5
V. Step Pilaster + Steps	x	x	901.8	x	x	902.0	x	x	x	x	897.4	x	x	904.7
W. Total Order Height to Floor	x	x	1025.1	x	x	1023.5	x	x	x	x	1023.1	x	x	1026.5

SAN LORENZO STEP PILASTER VERTICAL DIMENSIONS, continued

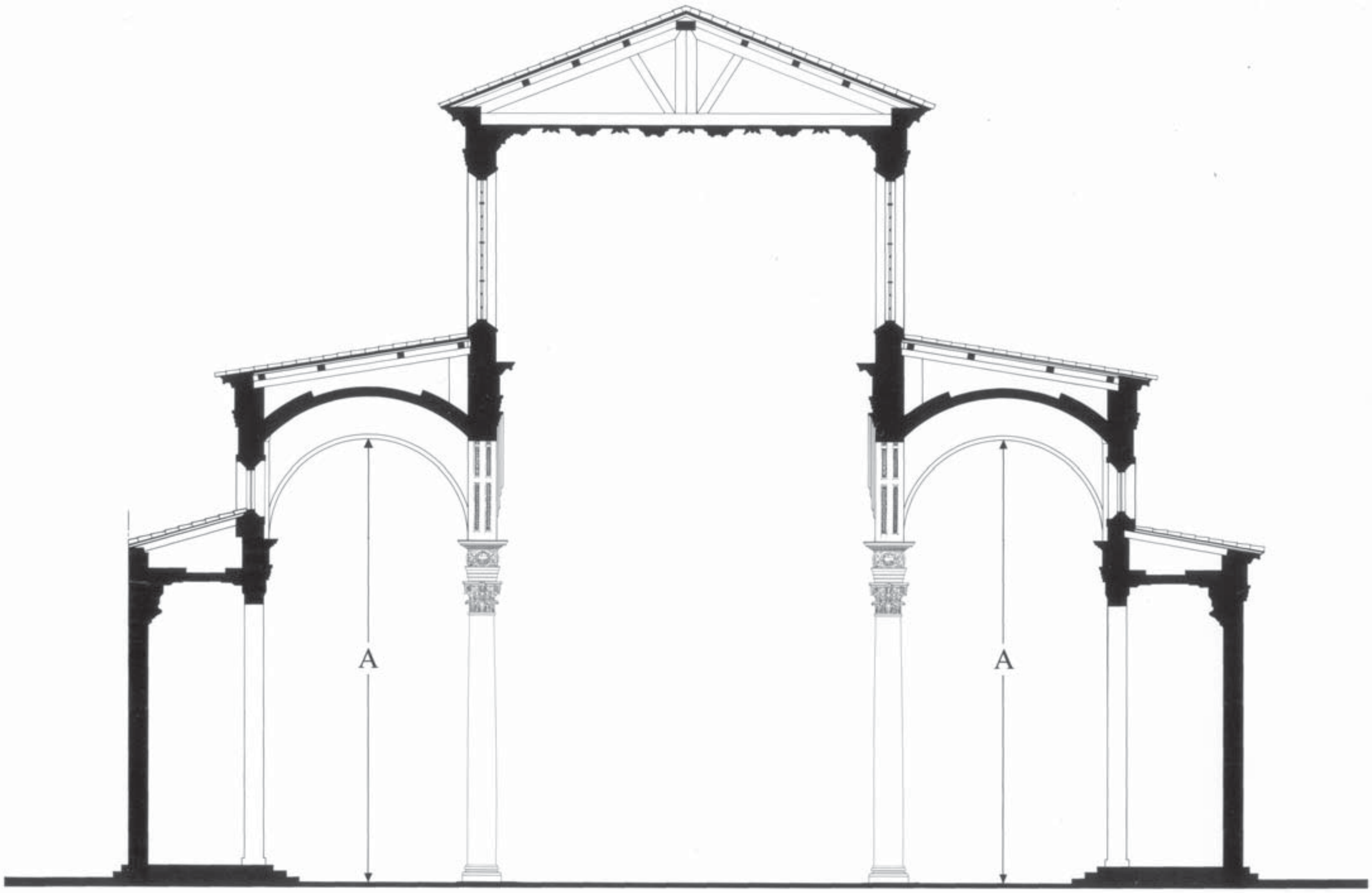
All measurements in cm

TRANSEPT, SOUTH

Step Pilaster Number:	SP 11	SP 12	SP 15	SP 16	SP 17	SP 18	SP 21	SP 23	SP 24	SP 25	SP 28	SP 29	SP 30	SP 33
A. Cornice (not including crown molding)	27.6	28.9	28.7	26.1	26.1	26.2	27.4	27.7	27.4	28.4	28.1	27.6	30.2	28.5
B. Frieze + Crown Molding	50.3	49.5	49.1	51.8	51.9	51.8	51.5	49.7	49.9	50.1	49.8	49.5	49.3	47.9
C. Architrave	46.0	45.8	45.8	45.2	45.2	45.1	45.2	45.3	45.1	45.4	44.9	45.5	45.6	45.9
D. Astragal	5.1	5.1	4.0	4.3	4.4	4.3	4.1	4.9	5.4	3.2	4.3	5.5	5.8	5.3
E. Base	24.9	24.8	25.6	25.4	25.5	25.4	25.4	25.3	25.5	25.5	25.5	25.5	25.4	25.2
F. Plinth	19.4	19.7	19.8	19.5	19.9	20.2	18.6	19.8	19.3	19.2	18.2	19.3	19.5	8.0
G. Entablature	123.9	124.2	123.6	123.1	123.2	123.1	124.1	122.7	122.4	123.9	122.8	122.6	125.1	122.3
H. Gap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I. Capital (including astragal)	97.3	97.4	97.5	97.2	97.2	97.3	97.3	97.9	98.1	97.3	98.6	98.7	98.5	98.7
J. Shaft	705.2	706.1	706.1	706.2	706.3	706.2	705.8	705.0	705.1	706.3	706.0	705.9	704.7	705.9
K. Base + Plinth	44.4	44.3	45.4	45.1	45.3	45.4	44.0	44.9	44.8	44.6	43.7	44.8	45.7	33.3
L. Raised Foundation	0	0	0	0	0	0	0	0	0	0	0	0	1.3	0
M. Third Step	19.3	x	x	18.7	x	x	x	x	17.7	x	x	18.1	x	x
N. Second Step	19.3	x	x	18.8	x	x	x	x	18.3	x	x	18.1	x	x
O. First Step	18.5	x	x	19.4	x	x	x	x	18.8	x	x	15.6	x	x
P. Capital + Entablature	221.2	221.6	221.1	220.3	220.4	222.0	221.4	220.6	220.5	221.2	220.4	221.3	223:6	221.0
Q. Shaft + Base + Plinth	749.6	750.4	751.5	751.6	751.6	751.5	749.8	749.9	749.9	750.9	750.7	750.7	750.4	739.2
R. Steps + Raised Foundation	56.3	x	x	55.8	x	x	x	x	54.4	x	x	51.5	x	x
S. Step Plaster	846.9	847.8	849.0	848.8	848.8	848.8	847.1	847.8	848.0	848.2	849.3	849.4	848.9	837.9
T. Total Order Height	970.8	972.0	972.6	971.3	972.0	972.0	971.2	970.5	970.4	972.1	971.1	972.0	974.0	960.2
U. Shaft Height to Floor	805.9	x	x	807.4	x	x	x	x	804.3	x	x	802.2	x	x
V. Step Pilaster + Steps	903.2	x	x	903.8	x	x	x	x	902.4	x	x	900.9	x	x
W. Total Order Height to Floor	1027.1	x	x	1026.8	x	x	x	x	1024.8	x	x	1023.5	x	x

NAVE SIDE AISLE, SOUTH

Step Pilaster Number:	SP 1	SP 2	SP 3	SP 4	SP 5	SP 6	SP 7	SP 8	SP 9	SP 10
A. Cornice (not including crown molding)	x	x	x	x	x	x	x	x	x	X
B. Frieze + Crown Molding	x	x	x	x	x	x	x	x	x	X
C. Architrave	x	x	42.0	45.8	46.0	46.3	46.0	46.2	46.7	46.3
D. Astragal	x	x	5.0	4.5	4.8	4.7	4.5	5.0	4.5	4.5
E. Base	26.9	27.0	26.3	23.5	26.6	26.5	23.2	25.0	25.3	25.3
F. Plinth	15.4	15.3	18.3	18.5	17.7	18.0	19.2	19.5	19.5	19.1
G. Entablature	x	X	121.2	128.5	126.0	126.1	130.2	124.0	124.3	124.3
H. Gap	-1.0	-1.0	-3.0	3.5	2.3	1.7	5.0	0.0	0.0	0.0
I. Capital (including astragal)	x	x	97.5	93.5	94.0	93.2	93.0	97.0	96.3	97.0
J. Shaft	x	x	707.7	704.5	705.9	709.2	707.6	704.8	705.4	705.1
K. Base + Plinth	42.1	42.3	44.6	42.0	44.3	44.5	42.4	44.5	44.8	44.4
L. Raised Foundation	0	0	0	0	0	0	0	0	0	0
M. Third Step	18.0	18.5	18.5	18.0	18.0	19.1	17.0	19.2	18.8	19.0
N. Second Step	17.5	17.6	18.3	17.5	19.0	18.0	17.6	19.5	19.0	19.5
O. First Step	16.3	16.5	15.7	16.5	16.0	19.0	19.0	19.1	19.3	18.5
P. Capital + Entablature	x	x	218.7	222.0	220.0	219.3	223.2	221.0	220.6	221.3
Q. Shaft + Base + Plinth	x	x	752.3	746.5	750.2	753.7	750.0	749.3	750.2	749.5
R. Steps + Raised Foundation	51.1	52.5	52.4	56.3	56.5	56.2	53.3	56.6	57.0	56.3
S. Step Plaster	x	x	849.8	840.0	844.2	846.9	843.0	846.3	846.5	846.5
T. Total Order Height	x	x	971.0	968.5	970.2	973.0	973.2	970.3	970.8	970.8
U. Shaft Height to Floor	x	x	804.7	802.8	806.7	809.9	803.3	805.9	807.2	805.8
V. Step Pilaster + Steps	x	x	902.2	896.3	900.7	903.1	896.3	902.9	903.5	902.8
W. Total Order Height to Floor	x	x	1023.4	1024.8	1026.7	1029.2	1026.5	1026.9	1027.8	1027.1



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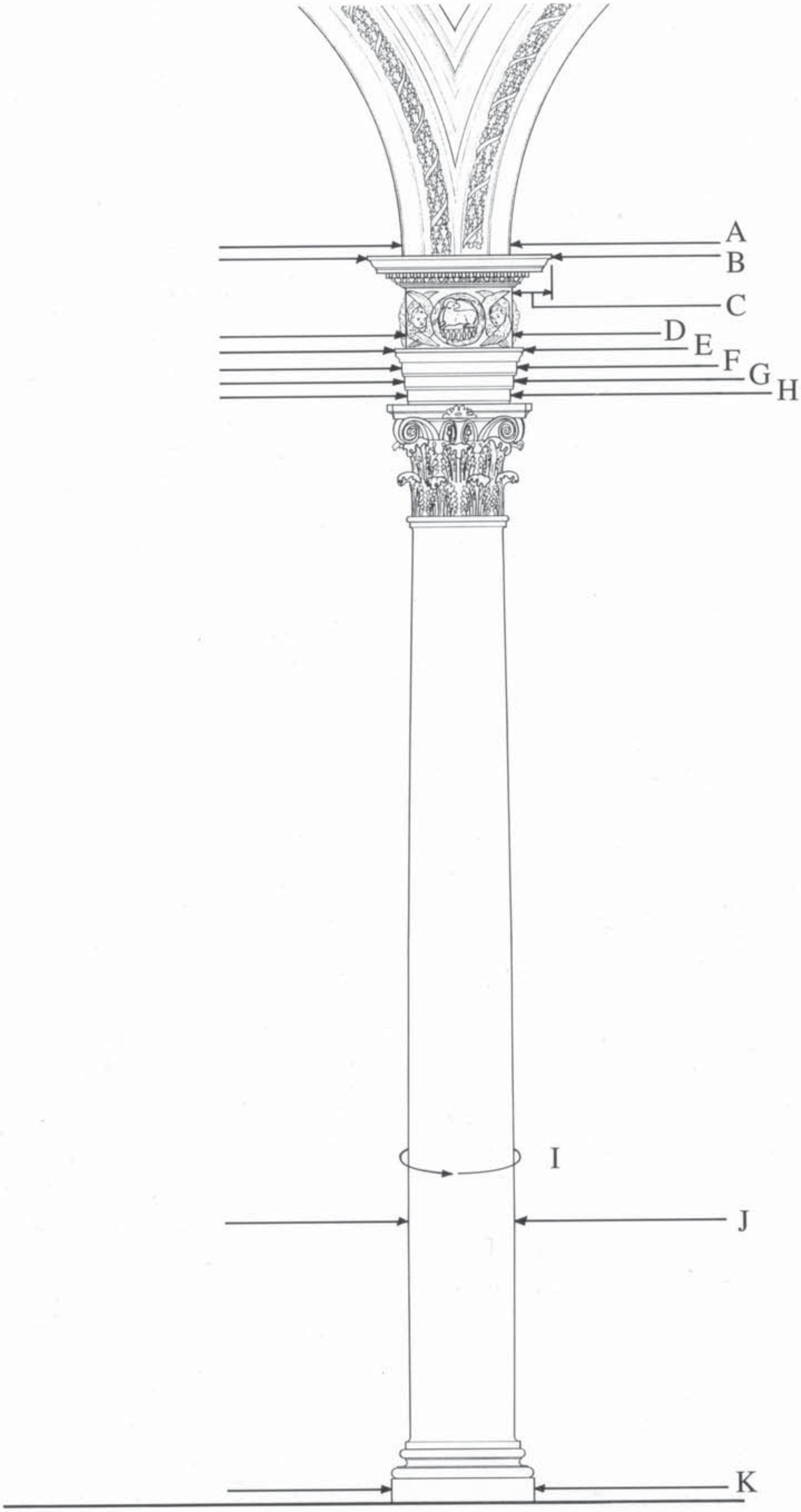
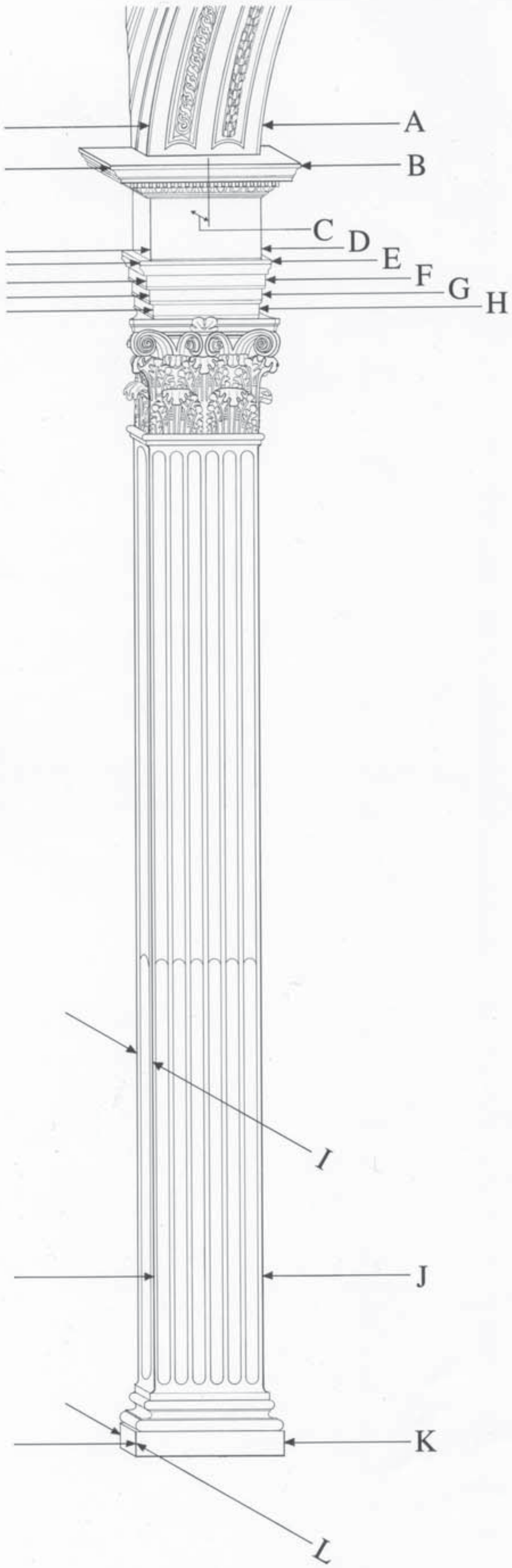
A

SAN LORENZO SIDE AISLE TRANSVERSE ARCH SOFFIT VERTICAL DIMENSIONS (HEIGHTS)								
All measurements in cm								
NAVE SIDE AISLE, NORTH								
Arch Number:	**FP 6—SP 65**	**COL 8—SP 66**	**COL 9—SP 67**	**COL 10—SP 68**	**COL 11—SP 69**	**COL 12—SP 70**	**COL 13—SP 71**	**COL 14—SP 72**
A. Arch Intradose to Floor	1318.5	1320.3	1321	1322.5	1324.5	1319.8	1325.0	1326.0
NAVE SIDE AISLE SOUTH								
Arch Number:	**SP 10—FP 5**	**SP 9—COL 7**	**SP 8—COL 6**	**SP 7—COL 5**	**SP 6—COL 4**	**SP 5—COL 3**	**SP 4—COL 2**	**SP 3—COL 1**
A. Arch Intradose to Floor	1318.5	1322.3	1322.2	1322.2	1320.0	1322.0	1321.0	1324.2



SAN LORENZO COLUMN HORIZONTAL DIMENSIONS



SAN LORENZO FLOOR PILASTER HORIZONTAL DIMENSIONS

SAN LORENZO COLUMN AND FLOOR PILASTER HORIZONTAL DIMENSIONS

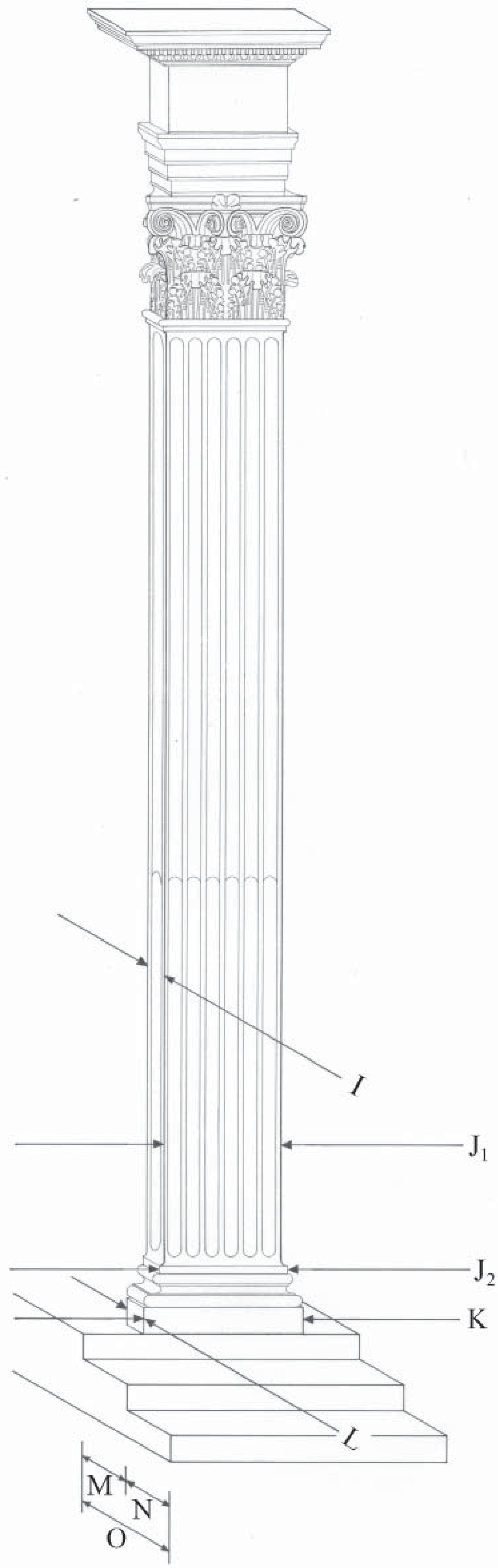
All measurements in cm

NAVE ARCADE, NORTH

Column and Floor Pilaster Number:	FP 7	COL 8	COL 9	COL 10	COL 11	COL 12	COL 13	COL 14	FP 9	FP 6
A: Archivolt Face or Intradose Width	x	x	x	x	x	x	x	x	x	x
B: Cornice Width	x	145.5	145.3	145.6	147.1	140.7	145	145.4	x	x
C: Cornice Projection from Frieze	28.7	29.0	28.9	29.0	30.3	27.1	29.7	29.4	30.6	29.3
D: Frieze Width	89.8	87.5	87.6	87.6	86.6	86.5	85.6	86.6	86.7	89.6
E: Architrave Width (fascia 4)	106.8	104.8	104.5	104.5	101.8	103.7	103.1	101.6	106.7	106.8
F: Architrave Width (fascia 3)	97.8	94.7	93.6	95.2	94.1	95.6	94.8	93.2	98.0	98.0
G: Architrave Width (fascia 2)	93.8	90.3	88.9	90.6	89.7	91.5	90.8	89.3	94.1	93.5
H: Architrave Width (fascia 1)	89.8	86.0	84.3	86.2	85.3	87.0	86.2	85.3	86.8	89.3
I-1: Circumference at Widest Entasis	x	270.8	270.8	278.1	261.7	277.9	266.5	281.4	x	x
I-2: Circumference at Shaft Base	x	298.9	298.2	297.0	287.0	298.6	294.1	301.3	x	x
I: Pilaster Shaft Projection (left)	30.7	x	x	x	x	x	x	x	30.2	30.3
I: Pilaster Shaft Projection (right)	30.5	x	x	x	x	x	x	x	30.4	30.5
J-1: Diameter at Widest Entasis	89.4	86.2	86.2	88.5	83.3	88.5	84.8	89.6	89.5	89.6
J-2: Diameter at Shaft Base	92.9	95.1	94.9	94.5	91.4	95.0	93.6	95.9	93.1	92.8
K: Plinth Width	116.9	116.9	116.8	116.7	115.4	115.4	116.4	117.2	116.3	116.8
L: Pilaster Plinth Projection (left)	30.5	x	x	x	x	x	x	x	31.1	30.7
L: Pilaster Plinth Projection (right)	30.5	x	x	x	x	x	x	x	31.5	30.5

NAVE ARCADE, SOUTH

Column and Floor Pilaster Number:	FP 4	COL 7	COL 6	COL 5	COL 4	COL 3	COL 2	COL 1	FP 2	FP 5
A: Archivolt Face or Intradose Width	x	x	x	x	x	x	x	x	x	x
B: Cornice Width	x	145.5	145.4	145.3	144.0	143.6	143.3	144.2	x	x
C: Cornice Projection from Frieze	29.5	28.7	28.7	28.9	28.8	28.4	28.3	28.5	29.5	29.8
D: Frieze Width	89.7	88.0	87.9	87.6	86.5	86.9	86.8	87.2	88.7	89.7
E: Architrave Width (fascia 4)	106.5	104.6	104.6	104.5	104.3	104.4	104.3	104.5	106.4	106.5
F: Architrave Width (fascia 3)	98.5	95.2	95.1	94.7	94.1	94.7	95.2	95.4	98.4	97.7
G: Architrave Width (fascia 2)	94.1	90.0	90.8	90.4	89.7	90.5	90.9	90.9	94.0	93.8
H: Architrave Width (fascia 1)	89.7	85.0	86.2	86.0	85.9	86.4	86.7	86.8	89.8	89.7
I-1: Circumference at Widest Entasis	x	276.5	273.6	273.5	275.2	271.3	274.3	272.5	x	x
I-2: Circumference at Shaft Base	x	299.8	297.8	295.0	295.5	295.8	297.5	293.5	x	x
I: Pilaster Shaft Projection (left)	30.5	x	x	x	x	x	x	x	30.2	30.5
I: Pilaster Shaft Projection (right)	30.3	x	x	x	x	x	x	x	30.2	30.4
J-1: Diameter at Widest Entasis	89.4	88.0	87.1	87.1	87.6	86.4	87.3	86.7	89.6	89.6
J-2: Diameter at Shaft Base	92.9	95.4	94.8	93.9	94.1	94.2	94.7	93.4	93.0	93.0
K: Plinth Width	117.0	116.7	116.7	116.8	117.1	117.0	116.9	115.5	118.1	116.9
L: Pilaster Plinth Projection (left)	30.5	x	x	x	x	x	x	x	30.8	30.6
L: Pilaster Plinth Projection (right)	30.6	x	x	x	x	x	x	x	31.2	30.7



San Lorenzo Step Pilaster Horizontal Dimensions

SAN LORENZO STEP PILASTER HORIZONTAL DIMENSIONS

All measurements in cm

NAVE SIDE AISLE, NORTH

Step Pilaster Number:	SP 65	SP 66	SP 67	SP 68	SP 69	SP 70	SP 71	SP 72	SP 73	SP 74
A-H: Not Used										
I. Shaft Projection (left)	x	12.2	x	9.1	9.5	9.1	9.0	8.9	8.8	x
I. Shaft Projection (right)	14.7	x	8.3	8.6	9.9	9.0	8.9	9.3	x	8.6
J-1. Shaft Width, Middle	89.6	89.9	89.8	90.0	89.9	89.9	89.8	89.8	33.0	30.8
J-2. Shaft Width at Base	93.0	93.9	93.3	93.3	95.6	94.2	94.4	93.3	29.9	30.8
K. Plinth Width	117.3	115.7	116.0	111.0	115.3	113.0	115.3	115.2	31.4	31.4
L. Plinth Projection (left)	x	25.8	x	21.7	22.5	22.2	22.3	22.0	22.5	x
L. Plinth Projection (right)	27.9	x	22.5	21.6	22.4	22.1	22.1	22.2	x	22.3
M. Second Step Tread Depth	33.0	37.3	37.3	37.1	37.0	37.1	37.5	37.6	37.8	x
N. First Step Tread Depth	37.4	37.8	37.4	37.5	37.6	36.8	36.3	36.9	37.6	x
O. Total Step Depth	70.1	74.9	74.4	74.3	74.0	73.9	73.7	74.3	75.3	x

TRANSEPT, NORTH

Step Pilaster Number:	SP 53	SP 54	SP 55	SP 56	SP 57	SP 58	SP 59	SP 60	SP 61	SP 62	SP 63	SP 64
A-H: Not Used												
I. Shaft Projection (left)	x	16.3	x	15.5	x	x	x	x	14.5	14.8	14.0	x
I. Shaft Projection (right)	16.7	15.5	15.4	x	x	x	x	14.8	x	x	x	x
J-1. Shaft Width, Middle	89.3	89.7	15.3	15.5	89.7	89.6	89.7	89.6	14.2	14.6	89.6	89.4
J-2. Shaft Width at Base	17.6	93.3	x	x	93.3	x	93.5	93.7	16.2	16.7	92.3	93.3
K. Plinth Width	x	116.6	29.5	29.0	117.1	x	117.0	117.5	28.0	27.9	117.5	117.5
L. Plinth Projection (left)	x	29.7	x	28.8	x	x	x	x	28.2	28.3	27.8	x
L. Plinth Projection (right)	29.9	x	28.9	x	x	x	x	28.8	x	x	x	x
M. Second Step Tread Depth	x	x	x	x	x	x	37.9	x	x	x	x	37.7
N. First Step Tread Depth	x	x	x	x	x	x	37.5	x	x	x	x	37.0
O. Total Step Depth	x	x	x	x	x	x	74.8	x	x	x	x	75.0

TRANSEPT, NORTH (Continued)

Step Pilaster Number:	SP 42	SP 43	SP 44	SP 45	SP 46	SP 47	SP 48	SP 49	SP 50	SP 51	SP 52
A-H: Not Used											
I. Shaft Projection (left)	30.6	x	16.1	15.5	x	x	x	16.1	15.7	x	x
I. Shaft Projection (right)	15.6	15.4	x	x	x	14.7	15.3	x	x	x	16.7
J-1. Shaft Width, Middle	89.7	15.5	15.4	89.6	89.6	89.4	15.6	15.5	89.4	89.2	89.3
J-2. Shaft Width at Base	93.0	17.4	17.0	92.9	92.9	92.8	17.1	18.4	93.1	93.2	x
K. Plinth Width	116.8	x	x	117.0	117.0	117.2	28.1	29.6	117.2	116.3	x
L. Plinth Projection (left)	30.5	x	x	27.4	x	x	x	28.3	29.2	x	x
L. Plinth Projection (right)	29.8	x	x	x	x	28.2	28.8	x	x	x	29.9
M. Second Step Tread Depth	x	x	x	x	204.1	x	x	x	x	37.8	x
N. First Step Tread Depth	x	x	x	x	37.0	x	x	x	x	37.7	x
O. Total Step Depth	x	x	x	x	241.0	x	x	x	x	74.5	x

HIGH ALTAR CHAPEL

Step Pilaster Number:	SP 34	SP 35	SP 36	SP 37	SP 38	SP 39	SP 40	SP 41
A-H: Not Used								
I. Shaft Projection (left)	x	8.6	x	8.8	8.7	8.7	8.3	15.2
I. Shaft Projection (right)	15.2	8.5	8.7	8.8	8.7	x	8.8	x
J-1. Shaft Width, Middle	30.6	85.6	8.5	85.8	85.6	8.6	85.6	30.6
J-2. Shaft Width at Base	30.6	x	x	x	x	x	x	30.6
K. Plinth Width	29.1	112.3	21.3	112.4	112.4	21.8	112.3	28.1
L. Plinth Projection (left)	x	21.6	x	22.0	22.0	22.0	21.7	30.5
L. Plinth Projection (right)	30.5	20.7	22.1	22.2	22.0	x	22.2	x
M. Second Step Tread Depth	x	x	x	x	x	x	x	x
N. First Step Tread Depth	x	x	x	x	x	x	x	x
O. Total Step Depth	x	x	x	x	x	x	x	x

SAN LORENZO STEP PILASTER HORIZONTAL DIMENSIONS, continued

All measurements in cm

TRANSEPT, SOUTH

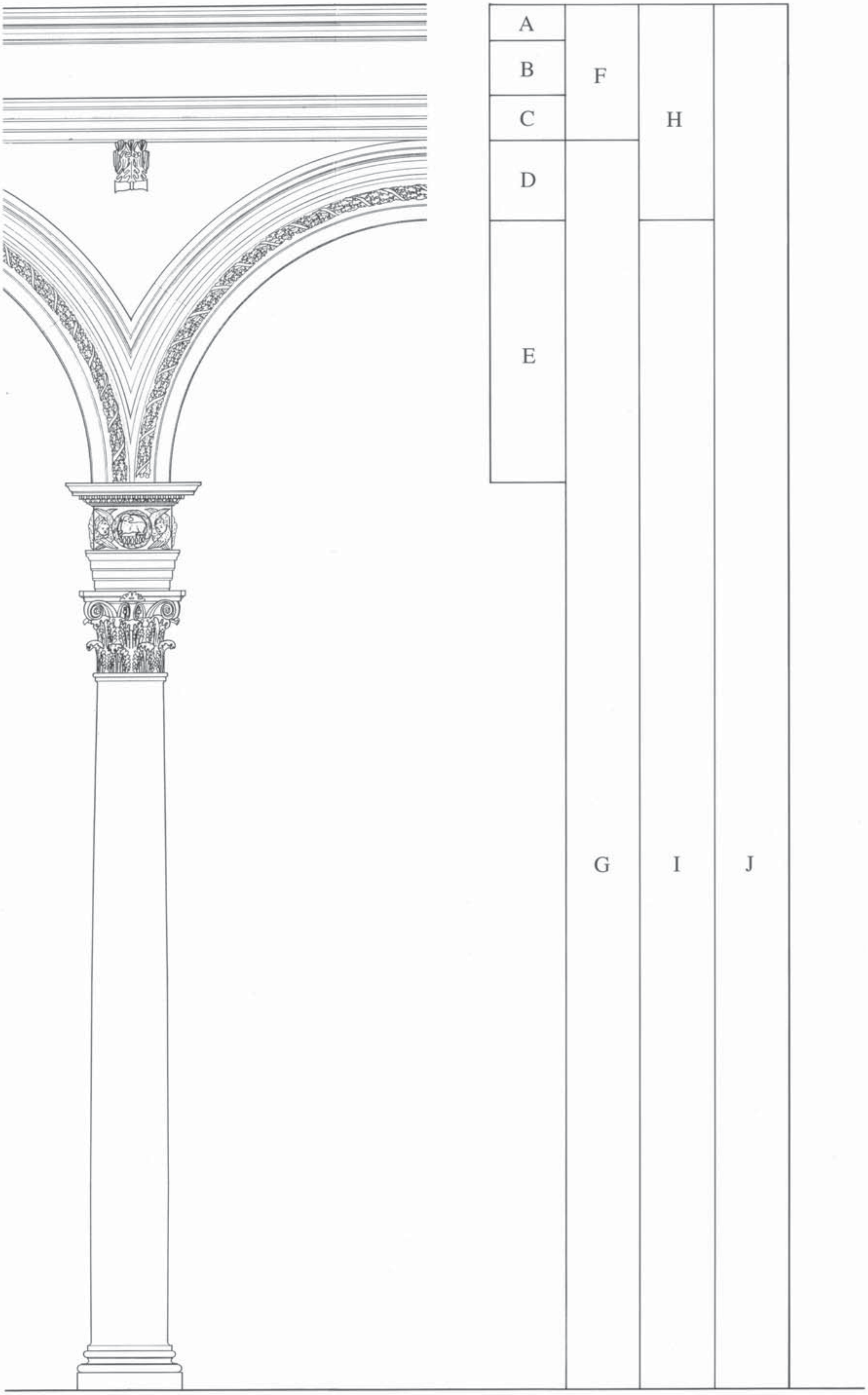
Step Pilaster Number:	SP 22	SP 23	SP 24	SP 25	SP 26	SP 27	SP 28	SP 29	SP 30	SP 31	SP 32	SP 33
A-H: Not Used												
I. Shaft Projection (left)	x	15.5	x	x	x	15.6	15.1	x	x	x	16.9	15.5
I. Shaft Projection (right)	15.7	x	x	15.5	15.2	x	x	x	15.3	16.8	x	x
J-1. Shaft Width, Middle	15.4	89.5	89.6	89.6	27.6	28.9	89.6	89.8	89.5	16.1	15.1	89.6
J-2. Shaft Width at base	x	x	93.5	95.2	16.3	18.1	93.0	93.1	93.6	17.5	16.5	93.2
K. Plinth Width	29.6	x	116.9	117.2	15.2	15.3	116.9	117.0	117.0	x	x	117.0
L. Plinth Projection (left)	x	x	x	x	x	28.7	27.7	x	x	x	x	28.3
L. Plinth Projection (right)	x	x	x	28.6	26.8	x	x	x	28.5	x	x	x
M. Second Step Tread Depth	x	x	37.5	x	x	x	x	204.0	x	x	x	x
N. First Step Tread Depth	x	x	37.2	x	x	x	x	37.0	x	x	x	x
O. Total Step Depth	x	x	74.3	x	x	x	x	240.8	x	x	x	x

TRANSEPT, SOUTH

Step Pilaster Number:	SP 11	SP 12	SP 13	SP 14	SP 15	SP 16	SP 17	SP 18	SP 19	SP 20	SP 21
A-H: Not Used											
I. Shaft Projection (left)	x	x	x	15.2	15.1	x	x	x	x	15.1	15.6
I. Shaft Projection (right)	x	15.0	15.3	x	x	x	x	15.2	x	x	15.6
J-1. Shaft Width, Middle	89.6	89.5	15.2	15.0	89.2	89.7	89.7	89.5	15.4	15.2	89.7
J-2. Shaft Width at Base	93.6	93.5	17.0	16.0	93.4	93.5	x	93.4	x	x	93.3
K. Plinth Width	116.9	116.9	28.4	28.0	117.4	117.2	x	117.1	29.2	29.0	117.4
L. Plinth Projection (left)	x	x	x	29.6	28.5	x	x	X	x	x	28.5
L. Plinth Projection (right)	x	28.4	28.3	x	x	x	x	28.6	x	x	28.4
M. Second Step Tread Depth	37.2	x	x	x	x	37.8	x	x	x	x	x
N. First Step Tread Depth	37.6	x	x	x	x	37.1	x	x	x	x	x
O. Total Step Depth	74.6	x	x	x	x	74.8	x	x	x	x	x

NAVE SIDE AISLE, SOUTH

Step Pilaster Number:	SP 1	SP 2	SP 3	SP 4	SP 5	SP 6	SP 7	SP 8	SP 9	SP 10
A-H: Not Used										
I. Shaft Projection (left)	8.4	x	8.8	8.6	8.8	8.4	8.5	8.9	8.4	15.5
I. Shaft Projection (right)	x	8.8	9.0	8.4	8.4	8.3	9.0	8.9	15.5	x
J-1. Shaft Width, Middle	38	30.1	89.4	89.6	89.7	89.8	89.7	89.5	89.5	89.5
J-2. Shaft Width at Base	30.3	30.0	94.3	93.4	93.0	93.5	92.8	93.7	93.6	93.5
K. Plinth Width	29.5	29.4	115.2	115.2	115.4	115.1	116.5	116.8	116.7	117.1
L. Plinth Projection (left)	21.8	x	22.4	22	22.6	21.1	21.2	22.3	22.0	30.4
L. Plinth Projection (right)	x	22.5	22.0	22.2	21.6	21.1	21.6	22.1	29.0	x
M. Second Step Tread Depth	x	37.7	37.7	38.5	38.4	38.3	37.1	38.0	38.2	38.6
N. First Step Tread Depth	x	38.2	37.2	37.5	37.3	38.1	38.3	37.5	37.4	37.8
O. Total Step Depth	x	75.5	74.5	74.6	74.6	75.3	75.2	75.5	75.6	76.4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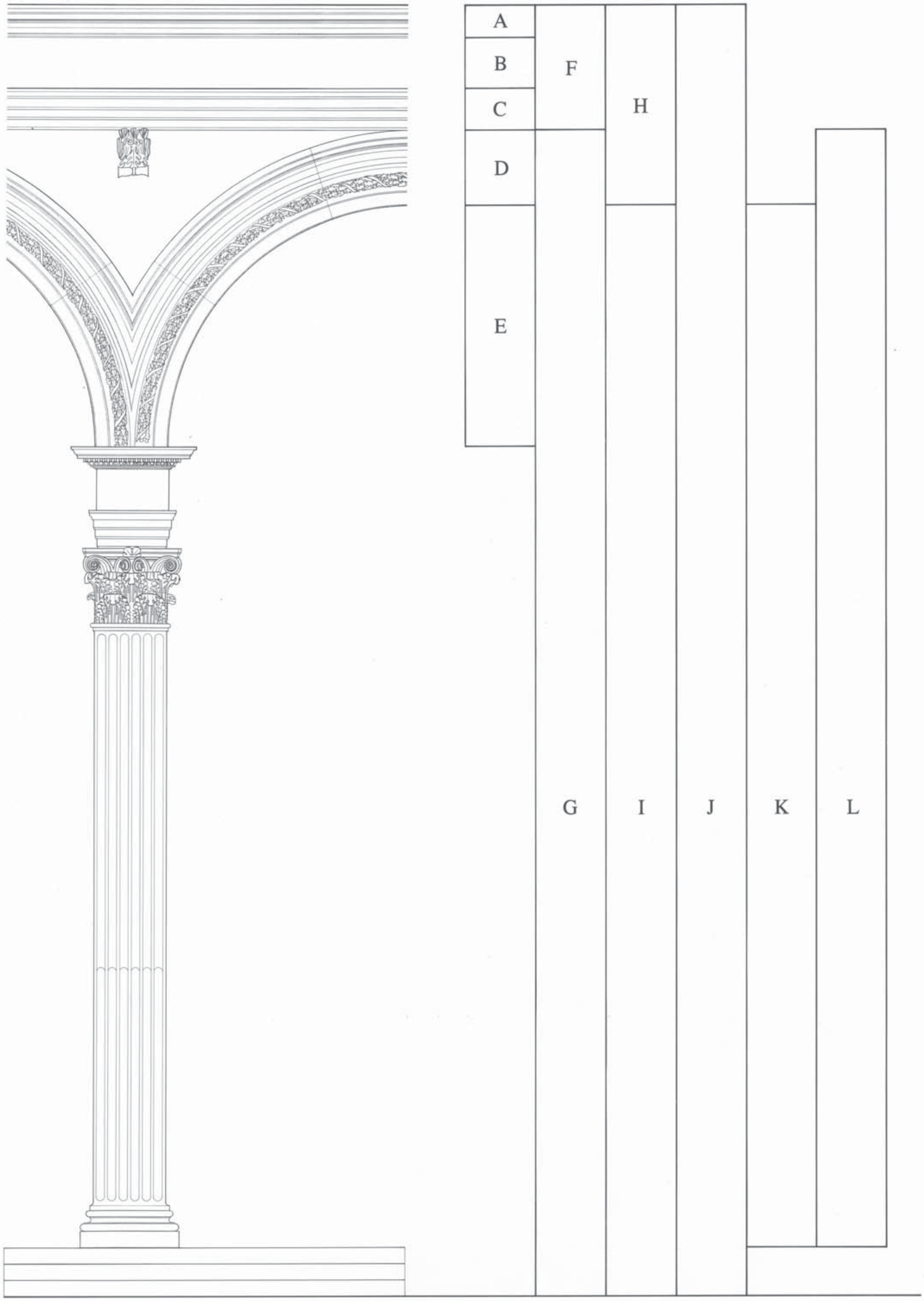
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SAN LORENZO ARCH AND UPPER ENTABLATURE VERTICAL DIMENSIONS

All measurements in cm

Note that D and E belong to the minor order, but for clarity are included with the major order dimensions below.

NAVE, NORTH

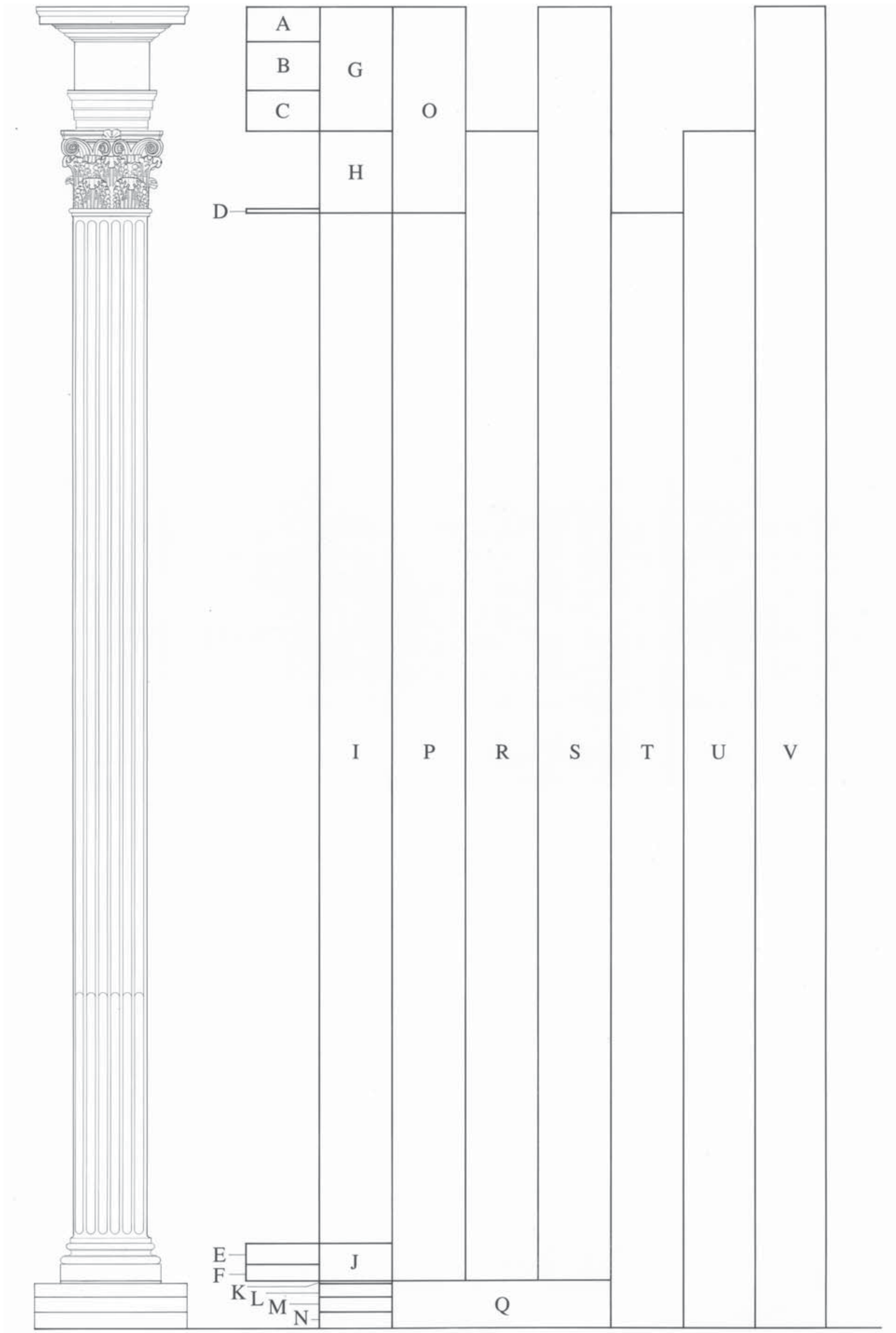
Bay Number:	FP 7—8	8—9	9—10	10—11	11—12	12—13	13—14	14—FP 9
A. Cornice	x	40.8	40.5	40.2	38.6	38.8	38.3	38.4
B. Frieze	x	61.6	61.8	56.2	53.2	53.9	54.9	56.7
C. Architrave	x	48.0	49.1	53.6	49.8	49.8	43.0	45.9
D. Archivolt	x	88.8	88.5	85.8	88.2	87.0	86.2	87.6
E. Arch Radius	x	294.1	291.6	294.2	299.2	295.2	299.4	297.3
F. Entablature	x	150.4	151.4	150.0	141.6	142.5	136.2	141.0
G. Top of Archivolt to Floor	x	1411.8	1409.8	1409.8	1416.7	1416.3	1422.7	1416.4
H. Entablature + Archivolt	x	239.2	239.9	235.8	229.8	229.5	222.4	228.6
I. Arch Intrados to Floor	x	1323.0	1321.3	1324.0	1328.5	1329.3	1336.5	1328.8
J. Top of Upper Entablature to Floor	1561.9	1562.2	1561.2	1559.8	1558.3	1558.8	1558.9	1557.4
K. Arch Intrados to Top Step	x	x	x	x	x	x	x	x
L. Top of Archivolt to Top Step	x	x	x	x	x	x	x	x

TRANSEPT

Bay Number:	FP 5—SP 10	SP 12—SP 15	SP 17—SP 23	SP 25—SP 28	SP 30—SP 33	SP 42—SP 45	SP 47—SP 50	SP 52—SP 58	SP 60—SP 63	SP 65—FP 6
A. Cornice	39.6	40.3	40.1	39.4	40.9	39.5	39.5	39.1	39.9	40.2
B. Frieze	63.7	62.9	62.9	64.0	64.2	64.0	64.2	63.9	64.4	63.7
C. Architrave	50.0	50.8	48.9	54.5	56.1	52.3	51.9	48.5	56.4	49.7
D. Archivolt	88.9	87.3	89.0	89.3	88.7	89.0	88.2	88.7	86.5	88.0
E. Arch Radius	289.8	290.7	294.1	287.0	281.5	284.9	285.4	294.5	284.7	289.9
F. Entablature	153.3	154.0	151.9	157.9	161.2	155.8	155.6	151.5	160.7	153.6
G. Top of Archivolt to Floor	1407.4	1406.6	1408.9	1399.4	1388.8	1397.9	1398.6	1406.2	1399.3	1406.5
H. Entablature + Archivolt	242.2	241.3	240.9	247.2	249.9	244.8	243.8	240.1	247.2	241.6
I. Arch Intrados to Floor	1318.5	1319.3	1319.9	1310.1	1300.1	1308.9	1310.4	1317.5	1312.8	1318.5
J. Top of Upper Entablature to Floor	1560.7	1560.6	1560.8	1557.3	1550.0	1553.7	1554.2	1557.6	1560.0	1560.1
K. Arch Intrados to Top Step	x	1263.3	1264.8	1257.2	1248.6	1254.6	1255.8	1263.0	1256.9	x
L. Top of Archivolt to Top Step	x	1350.6	1353.8	1346.5	1337.3	1343.6	1344.0	1351.7	1343.4	x

NAVE, SOUTH

Bay Number:	FP 2—1	1—2	2—3	3—4	4—5	5—6	6—7	7—FP 4
A. Cornice	40.6	40.6	40.2	40.4	40.6	40.7	41.0	x
B. Frieze	61.3	61.4	61.8	60.8	60.8	61.6	62.3	x
C. Architrave	49.3	40.8	49.3	51.5	47.9	47.4	49.0	x
D. Archivolt	88.0	96.1	88.8	88.8	89.3	87.8	88.2	x
E. Arch Radius	293.4	294.3	293.9	292.4	292.1	293.4	291.8	x
F. Entablature	151.2	142.8	151.3	152.7	149.5	149.7	152.3	0
G. Top of Archivolt to Floor	1410.3	1420.1	1411.8	1409.8	1410.3	1410.8	1409.4	x
H. Entablature + Archivolt	239.2	238.9	240.1	241.5	238.6	237.5	240.5	x
I. Arch Intrados to Floor	1322.3	1324.0	1323.0	1321.0	1321.0	1323.0	1321.2	x
J. Top of Upper Entablature to Floor	1561.5	1562.9	1563.1	1562.5	1559.6	1560.5	1561.7	1561.4
K. Arch Intrados to Top Step	x	x	x	x	x	x	x	x
L. Top of Archivolt to Top Step	x	x	x	x	x	x	x	x

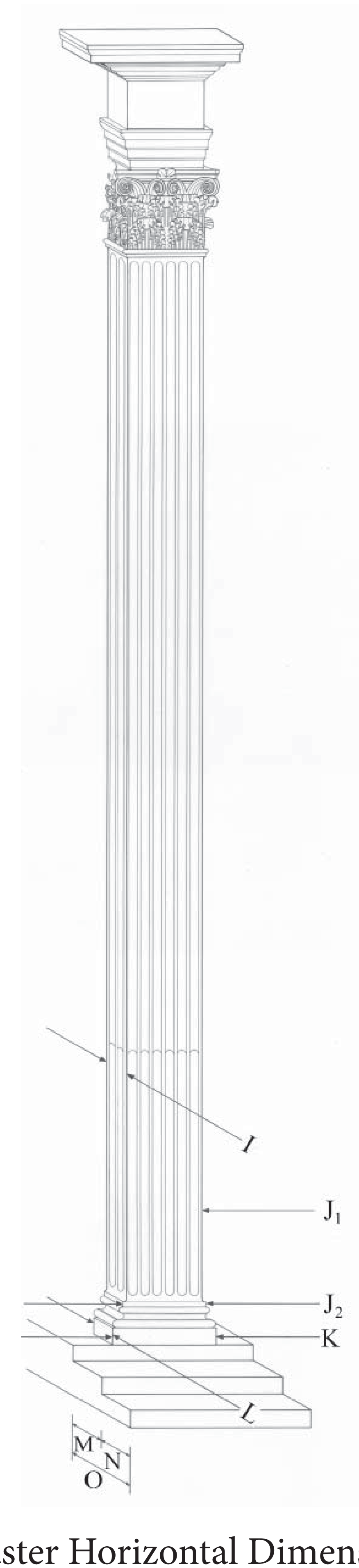


San Lorenzo Crossing Pilaster Vertical Dimensions

SAN LORENZO CROSSING PILASTER VERTICAL DIMENSIONS

All measurements in cm

Crossing Pilaster Number:	CP 1	CP 2	CP 3	CP 4	CP 5	CP 6	CP 7	CP 8
A. Cornice	39.5	39.8	40.4	x	x	40.5	40.2	40.5
B. Frieze	63.7	63.3	62.3	x	x	61.9	63.3	62.7
C. Architrave	47.8	47.5	49.1	x	x	48.5	47.5	48.4
D. Astragal	4.7	5.2	5.9	x	x	5.3	4.6	4.3
E. Base	25.3	25.2	25.3	25.1	25.4	25.3	25.3	25.3
F. Plinth	18.5	18.6	8.0	7.2	14.2	14.6	18.9	18.7
G. Entablature	151.0	150.6	151.8	x	x	150.9	151.0	151.6
H. Capital (including astragal)	97.0	97.9	98.4	x	x	97.8	96.7	96.8
I. Shaft (excluding astragal)	1268.7	1268.9	1210.6	x	x	1210.2	1268.6	1268.8
J. Base + Plinth	43.8	43.7	33.3	32.2	39.7	39.9	44.2	44.0
K. Raised Foundation	0	0	0	0	0	0	0	0
L. Third Step	x	x	16.7	x	x	17.4	x	x
M. Second Step	x	x	16.3	x	x	16.6	x	x
N. First Step	x	x	17.4	x	x	16.4	x	x
O. Capital + Entablature	248.0	248.5	250.2	x	x	248.7	247.7	248.4
P. Shaft + Base + Plinth	1312.5	1312.6	1243.9	x	x	1250.1	1312.8	1312.8
Q. Steps + Raised Foundation	x	x	50.2	x	x	50.4	x	x
R. Crossing Pilaster Height	1409.5	1410.5	1342.3	x	x	1347.9	1409.5	1409.6
S. Total Order Height	x	x	1494.1	x	x	1498.8	x	x
T. Shaft Height to Floor	1312.5	1312.6	1294.1	x	x	1300.5	1312.8	1312.8
U. Top of Capital to Floor	1409.5	1410.5	1392.5	x	x	1398.3	1409.5	1409.6
V. Total Order Height to Floor	1560.5	1561.1	1544.3	x	x	1549.2	1560.5	1561.2

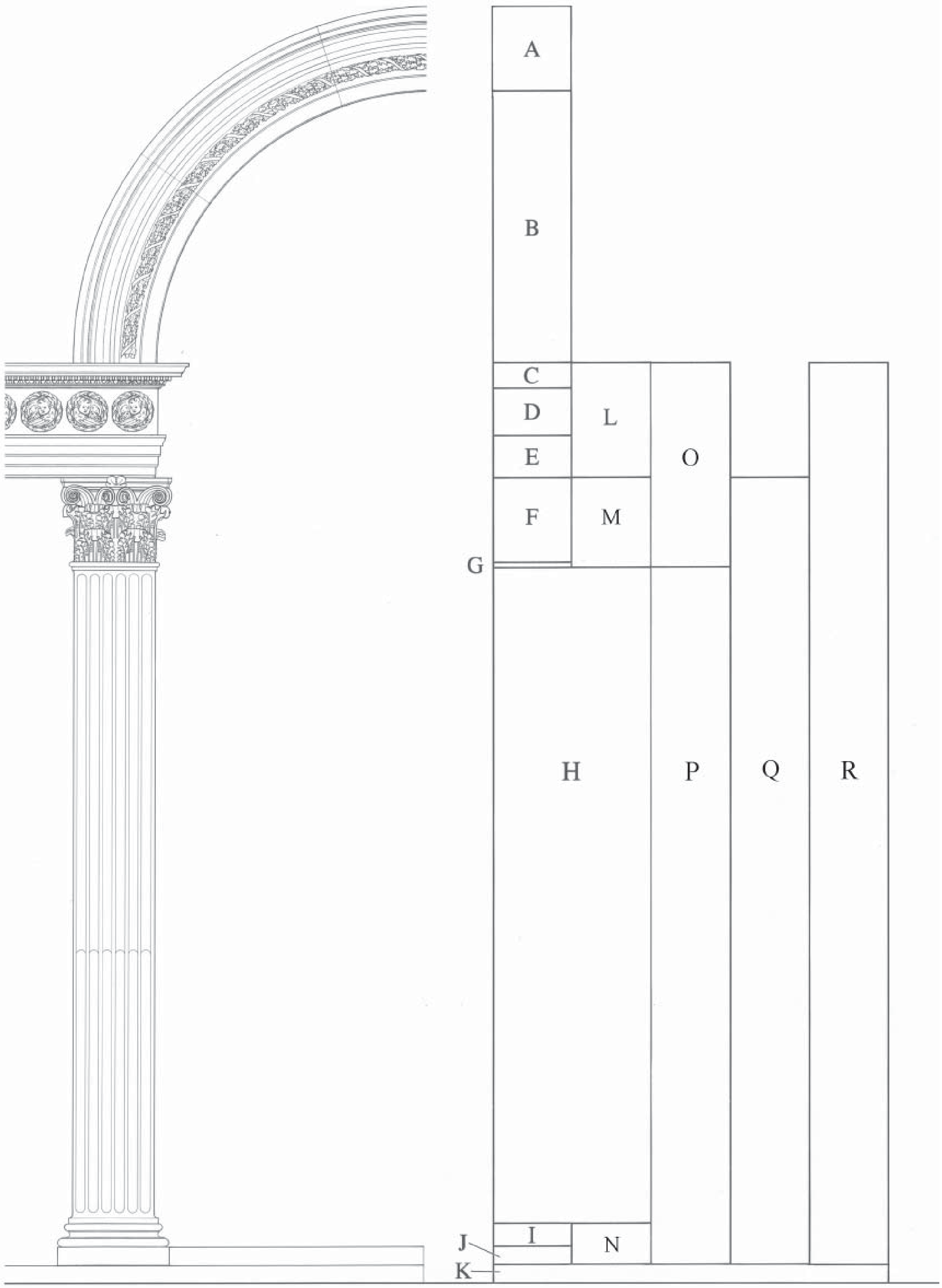


San Lorenzo Crossing Pilaster Horizontal Dimensions

SAN LORENZO CROSSING PILASTER HORIZONTAL DIMENSIONS								
All measurements in cm								
Crossing Pilaster Number:	**CP 1**	**CP 2**	**CP 3**	**CP 4**	**CP 5**	**CP 6**	**CP 7**	**CP 8**
A-H: Not Used								
I. Shaft Projection (left)	30.5	30.5	30.3	30.6	30.5	30.6	30.3	30.4
I. Shaft Projection (right)	30.5	30.6	30.5	30.7	30.6	30.5	30.4	30.5
J-1. Shaft Width, Middle	89.5	89.5	89.7	89.8	89.6	89.6	89.4	89.4
J-2. Shaft Width at Base	93.0	93.0	93.2	93.0	93.2	93.2	92.8	92.8
K. Plinth Width	116.9	116.8	x	116.8	x	x	116.8	116.8
L. Plinth Projection (left)	30.7	30.7	30.5	30.3	30.6	30.6	30.6	30.6
L. Plinth Projection (right)	30.6	30.6	30.4	30.5	x	30.5	30.6	30.6
M. Second Step Depth	x	x	171.9	x	x	174.3	x	x
N. First Step Depth	x	x	36.5	x	x	36.5	x	x
O. First + Second Step Depth	x	x	209.0	x	x	210.8	x	x

Appendix 8.2: Old Sacristy Survey

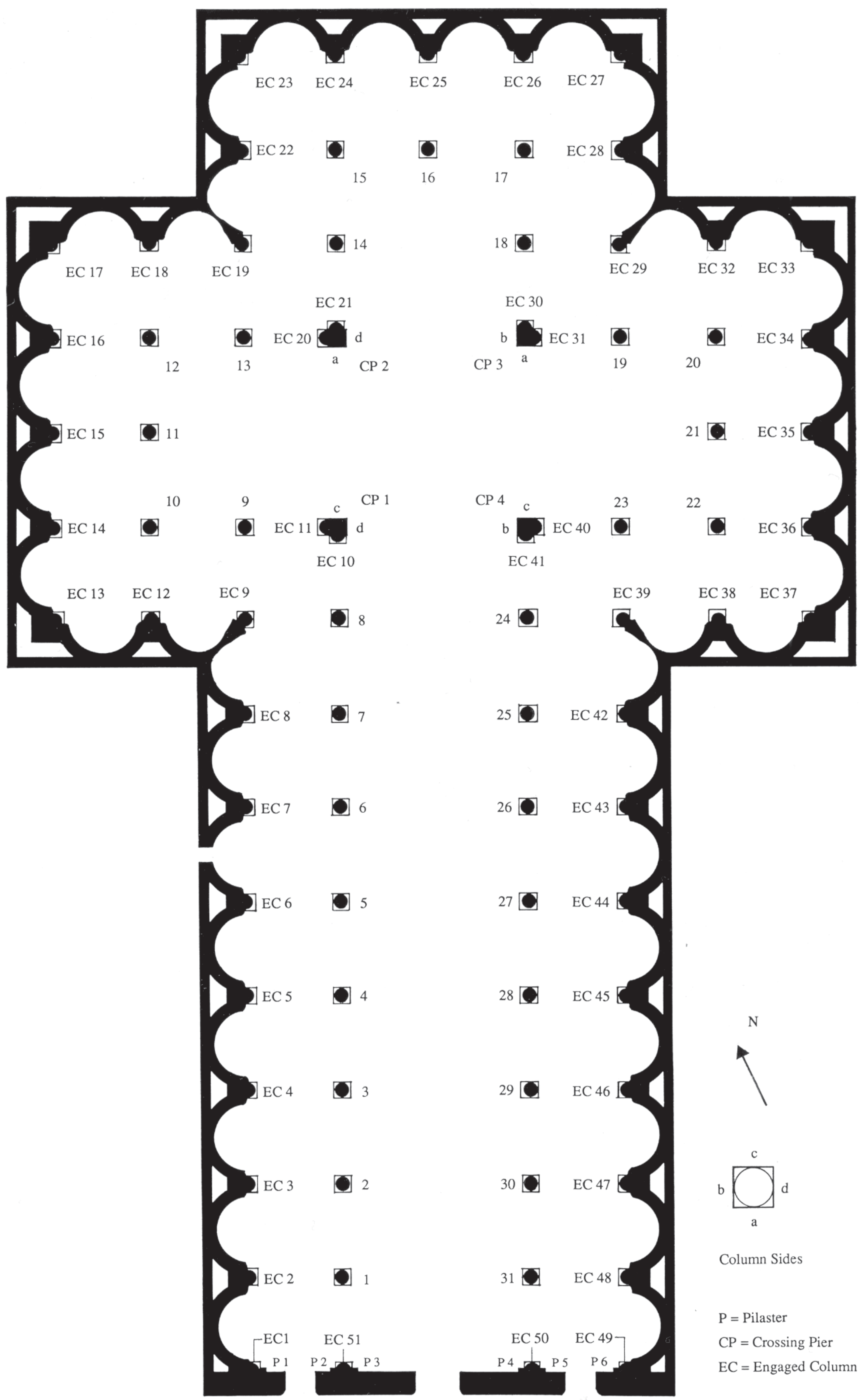
(See also Figures 3-27 to 3-29)



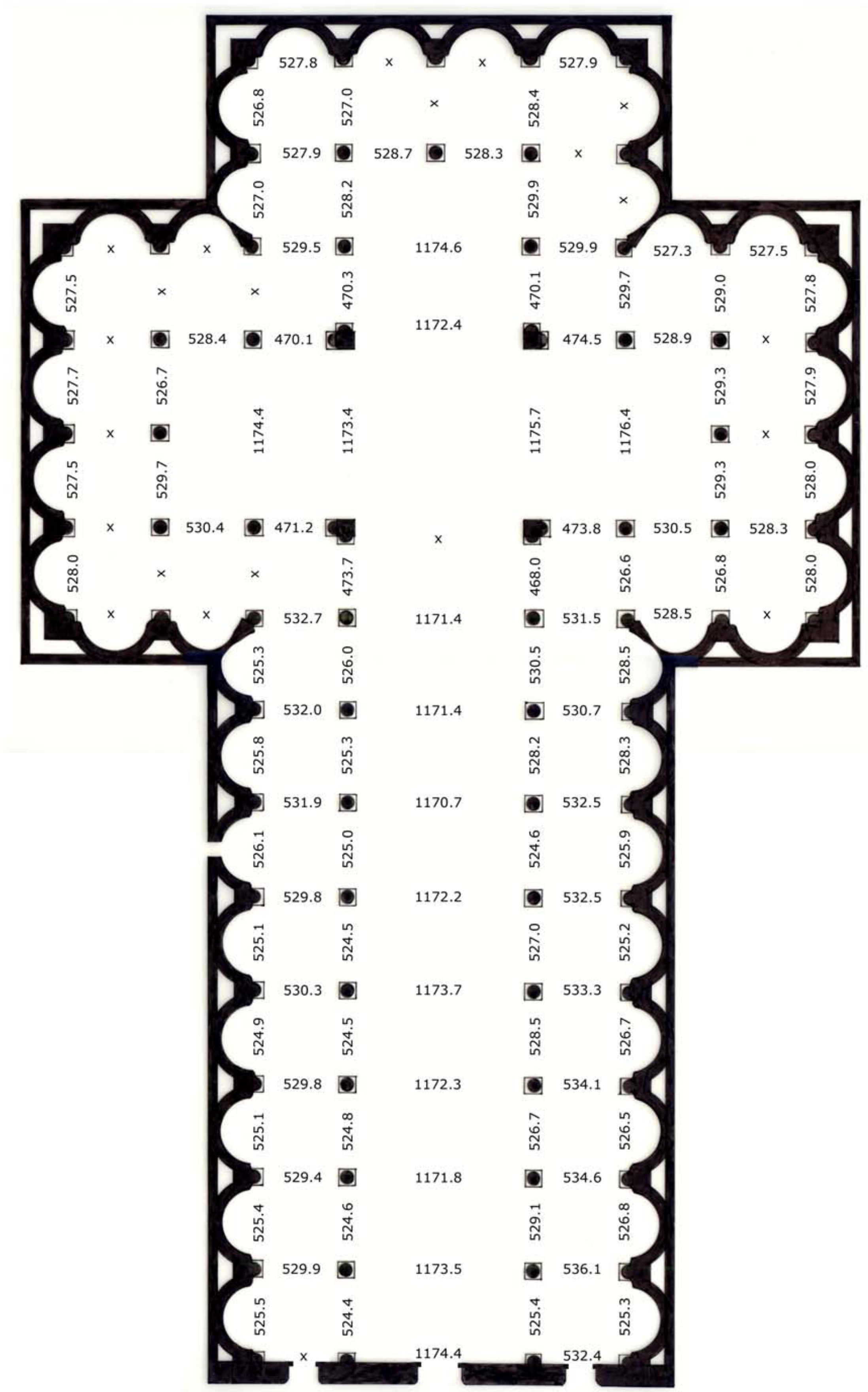
Old Sacristy, Scarsella Step Pilaster Vertical Dimensions

OLD SACRISTY SCARSELLA STEP PILASTER VERTICAL DIMENSIONS			
All measurements in cm			
	East Pilaster (Left)	**West Pilaster (Right)**	**Between**
A. Archivolt Face Width			63.3
B. Arch Radius (to intrados)			201.8
C. Entablature Cornice	21.9	21.9	
D. Frieze	41.3	41.1	
E. Architrave	35.5	36	
F. Capital (without astragal)	64.0	62.7	
G. Astragal	4.1	4.2	
H. Shaft (without astragal)	506.8	507.3	
I. Base	19.2	19.3	
J. Plinth	17.7	17.8	
K. Step Below Plinth	18.7	17.9	
L. Entablature	98.7	99	
M. Capital (including astragal)	68.1	66.9	
N. Base + Plinth	36.9	37.1	
O. Entablature + Capital (including astragal)	166.8	165.9	
P. Shaft (not including astragal) + Base + Plinth	543.7	544.4	
Q. Pilaster	611.8	611.3	
R. Total Order	710.5	710.3	

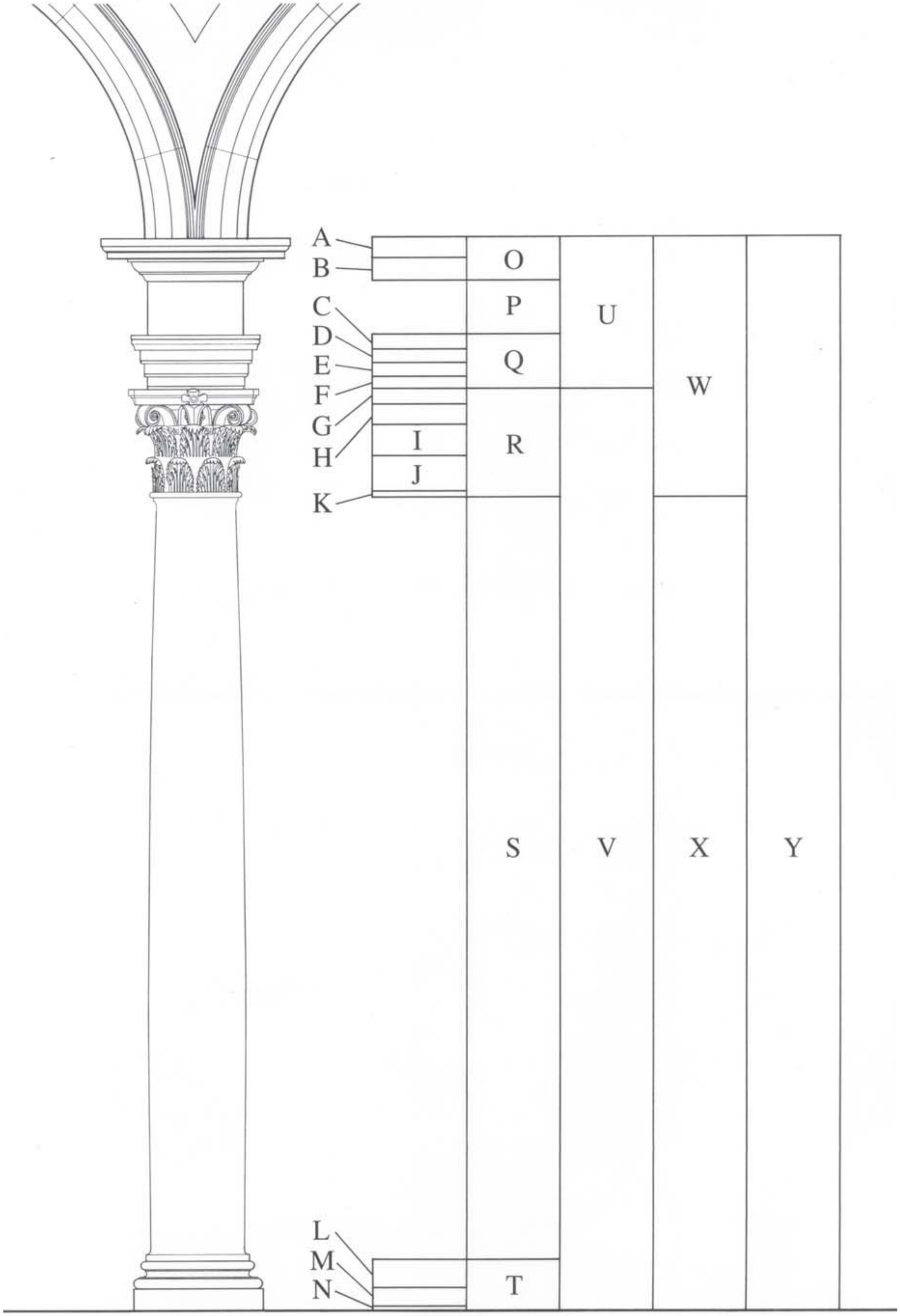
Appendix 8.3: Santo Spirito Survey



Santo Spirito Key Plan



Santo Spirito Overall Floor Plan Measurements



Santo Spirito Column Vertical Dimensions

SANTO SPIRITO COLUMN VERTICAL DIMENSIONS

All measurements in cm

NAVE, WEST

Column Number:	EC 51	COL 1	COL 2	COL 3	COL 4	COL 5	COL 6	COL 7	COL 8	EC 10
Side of Column Measured:	c	d	d	d	d	d	d	d	d	a
A. Cornice Upper Projection	17.7	23.0	19.4	20.4	18.4	18.4	17.7	19.8	18.5	18.3
B. Cornice Crown Molding	18.1	15.3	20.3	18.5	20.8	19.8	21.0	20.1	19.2	18.8
C. Architrave (fascia 1)	13.7	13.7	13.3	13.5	14.0	13.5	13.6	13.9	15.5	13.9
D. Architrave (fascia 2)	12.2	12.0	12.1	12.1	11.9	11.8	12.0	11.8	11.4	11.8
E. Architrave (fascia 3)	12.3	12.2	13.1	11.7	11.9	12.1	12.0	12.0	12.0	11.8
F. Architrave (fascia 4)	11.1	11.9	12.0	11.9	10.9	10.2	11.4	10.4	11.4	11.2
G. Abacus	14.9	14.3	14.8	15.6	14.3	12.5	15.7	15.7	13.5	12.2
H. Volute	19.5	19.8	19.6	19.7	16.8	17.6	16.9	17.3	18.0	18.4
I. Acanthus Leaf (upper)	27.0	32.5	25.9	25.1	27.4	31.5	26.2	25.5	25.5	36.3
J. Acanthus Leaf (lower)	31.8	33.2	31.1	33.9	32.6	30.4	33.7	34.5	34.5	31.7
K. Astragal	5.8	5.9	5.8	6.2	6.1	6.0	6.3	5.4	6.2	5.6
L. Base	25.0	24.7	24.6	23.3	24.7	23.9	24.9	24.7	22.3	25.1
M. Plinth	18.0	17.6	19.1	18.4	18.0	18.6	18.5	18.9	18.5	19.4
N. Raised Foundation	0	0	0	0	0	0	0	0	0	0.5
O. Cornice	35.8	38.3	39.7	38.9	39.2	38.2	38.7	39.9	37.7	37.1
P. Frieze	53.0	48.5	49.1	49.2	53.2	52.0	49.1	50.1	57.5	49.0
Q. Architrave	49.4	49.0	49.7	48.8	48.2	47.3	49.0	47.5	50.3	48.7
R. Capital (including astragal)	97.7	97.1	97.3	98.3	94.4	96.6	97.5	97.3	97.3	97.7
S. Shaft Monolith (excluding astragal)	701.5	704.0	705.0	706.8	703.7	703.0	704.7	705.4	692.3	699.9
T. Base + Plinth + Raised Foundation	42.9	42.4	43.6	41.7	42.6	42.6	43.4	43.5	40.7	44.9
U. Entablature Block	138.4	136.3	138.8	136.9	140.7	137.9	137.1	137.8	145.5	135.1
V. Column	842.1	843.5	845.9	846.8	840.7	842.2	845.6	846.2	830.3	842.5
W. Capital + Entablature Block	236.1	233.4	236.1	235.2	235.1	234.5	234.6	235.1	242.8	232.8
X. Shaft (to floor, excluding astragal)	744.4	746.4	748.6	748.5	746.3	745.6	748.1	748.9	733.0	744.8
Y. Minor Order	980.5	979.8	984.7	983.7	981.4	980.1	982.7	984.0	975.8	977.6

TRANSEPT, WEST

Column Number:	EC 11	COL 9	COL 10	COL 11	COL 12	COL 13	EC 20
Side of Column Measured:	b	c	d	d	a	a	b
A. Cornice Upper Projection	18.5	19.1	18.6	19.1	16.6	17.8	18.3
B. Cornice Crown Molding	18.2	20.1	19.3	20.3	18.6	20.6	18.1
C. Architrave (fascia 1)	13.1	14.9	13.3	13.7	13.8	14.3	13.1
D. Architrave (fascia 2)	12.0	10.7	12.5	11.7	12.0	11.5	10.8
E. Architrave (fascia 3)	12.1	11.3	11.7	11.9	12.1	11.6	10.6
F. Architrave (fascia 4)	11.6	11.8	11.3	11.0	13.0	13.5	11.2
G. Abacus	12.0	13.7	14.1	14.0	13.1	13.5	12.1
H. Volute	18.9	17.2	16.2	18.1	17.6	19.0	20.4
I. Acanthus Leaf (upper)	32.4	29.8	30.2	29.3	33.0	32.4	36.7
J. Acanthus Leaf (lower)	28.2	30.8	30.9	31.3	28.8	28.4	28.2
K. Astragal	5.7	5.0	5.6	4.8	4.6	4.4	5.9
L. Base	24.1	22.8	24.4	24.8	24.7	23.6	24.8
M. Plinth	19.2	18.4	19.3	19.5	19.4	19.2	19.5
N. Raised Foundation	1.0	0	0	0	0.8	0	0
O. Cornice	36.7	39.2	37.9	39.4	35.2	38.4	36.4
P. Frieze	49.7	49.6	49.8	50.4	47.2	47.7	52.3
Q. Architrave	48.6	48.5	48.6	48.0	50.7	50.8	45.6
R. Capital (including astragal)	97.5	96.8	97.4	97.9	97.2	98.1	96.9
S. Shaft Monolith (excluding astragal)	699.8	702.3	699.1	699.5	703.8	698.9	696.7
T. Base + Plinth + Raised Foundation	45.0	41.1	43.8	44.4	44.9	43.0	44.5
U. Entablature Block	135.0	137.5	136.5	138.0	133.3	137.0	134.4
V. Column	842.3	840.2	840.3	841.8	845.9	840.0	838.1
W. Capital + Entablature Block	232.5	234.3	233.9	235.9	230.5	235.1	231.3
X. Shaft (to floor, excluding astragal)	744.8	743.4	742.9	743.9	748.7	741.9	741.2
Y. Minor Order	977.3	977.7	976.8	979.8	979.2	977.0	972.5

TRANSEPT, NORTH

Column Number:	EC 21	COL 14	COL 15	COL 16	COL 17	COL 18	EC 30
Side of Column Measured:	c	d	d	a	b	b	c
A. Cornice Upper Projection	18.5	17.8	19.5	19.9	16.4	18.4	18.4
B. Cornice Crown Molding	18.2	19.3	19.7	17.6	21.6	20.5	19.6
C. Architrave (fascia 1)	13.0	13.2	12.3	13.5	13.2	13.3	13.6
D. Architrave (fascia 2)	11.0	11.9	10.9	11.7	12.2	11.5	11.8
E. Architrave (fascia 3)	11.0	12.2	11.7	11.4	11.5	11.8	11.9
F. Architrave (fascia 4)	10.5	11.8	11.7	12.2	11.5	11.6	11.6
G. Abacus	12.2	13.5	12.5	13.2	13.5	12.0	11.7
H. Volute	21.5	17.0	17.2	18.9	16.6	18.1	19.3
I. Acanthus Leaf (upper)	35.6	28.7	30.1	29.6	30.5	30.5	32.3
J. Acanthus Leaf (lower)	27.4	31.0	31.1	31.5	27.9	32.7	27.0
K. Astragal	5.8	4.8	5.0	4.6	5.2	4.8	6.1
L. Base	24.7	24.9	25.1	25.6	24.9	24.8	24.8
M. Plinth	19.5	18.8	18.8	19.3	19.0	19.3	19.0
N. Raised Foundation	1.7	0	0	0	0	0	0
O. Cornice	36.7	37.1	39.2	37.5	38.0	38.9	38.0
P. Frieze	52.0	47.7	50.7	48.2	54.5	48.5	48.7
Q. Architrave	45.5	48.8	46.7	48.6	48.2	48.4	48.7
R. Capital (including astragal)	97.1	95.3	95.0	97.6	93.0	95.1	97.5
S. Shaft Monolith (excluding astragal)	696.0	704.5	701.5	702.8	706.6	704.3	700.1
T. Base + Plinth + Raised Foundation	45.8	43.8	43.9	43.9	44.0	44.1	43.7
U. Entablature Block	134.3	133.9	136.8	134.3	140.5	136.0	135.3
V. Column	838.9	843.6	840.4	844.3	843.6	843.5	841.3
W. Capital + Entablature Block	231.4	229.2	231.8	231.9	233.5	231.1	232.8
X. Shaft (to floor, excluding astragal)	741.8	748.3	745.4	746.7	750.6	748.4	743.8
Y. Minor Order	973.2	977.5	977.2	978.6	984.1	979.5	976.6

SANTO SPIRITO COLUMN VERTICAL DIMENSIONS, continued

All measurements in cm

TRANSEPT, EAST

Column Number:	EC 31	COL 19	COL 20	COL 21	COL 22	COL 23	EC 40
Side of Column Measured:	d	a	b	b	b	c	d
A. Cornice Upper Projection	18.5	18.1	19.4	18.9	17.4	20.1	19.3
B. Cornice Crown Molding	19.9	21.0	20.0	20.4	20.9	20.4	19.6
C. Architrave (fascia 1)	13.1	13.5	14.5	13.5	14.0	13.2	13.6
D. Architrave (fascia 2)	11.8	11.5	11.9	11.7	11.4	13.4	11.2
E. Architrave (fascia 3)	12.0	12.3	12.1	12.4	11.5	13.4	12.2
F. Architrave (fascia 4)	12.1	11.7	11.5	11.7	12.0	13.6	11.5
G. Abacus	12.5	13.0	10.9	13.2	14.7	10.4	12.5
H. Volute	19.6	20.2	19.8	18.0	16.5	19.0	20.3
I. Acanthus Leaf (upper)	31.0	28.5	30.0	27.0	28.5	31.2	28.7
J. Acanthus Leaf (lower)	29.2	31.7	30.0	31.7	31.3	35.7	28.4
K. Astragal	5.7	4.8	4.5	5.7	5.3	5.6	5.6
L. Base	24.8	24.4	25.9	24.6	24.8	26.5	24.8
M. Plinth	19.0	18.3	19.5	21.0	19.4	18.5	18.8
N. Raised Foundation	0.3	1.0	0	0	0	0	0
O. Cornice	38.4	39.1	39.4	39.3	38.3	40.5	38.9
P. Frieze	48.3	48.6	46.8	49.0	49.3	53.3	51.5
Q. Architrave	49.2	48.9	49.5	48.7	48.4	53.7	48.4
R. Capital (including astragal)	97.2	97.4	97.0	95.0	94.0	98.3	95.5
S. Shaft Monolith (excluding astragal)	699.3	698.3	699.0	702.5	707.4	688.2	700.6
T. Base + Plinth + Raised Foundation	44.0	43.6	45.3	45.6	44.1	45.1	43.7
U. Entablature Block	136.0	136.7	135.8	137.0	136.1	147.5	139.0
V. Column	840.5	839.3	841.3	843.1	845.5	831.6	839.8
W. Capital + Entablature Block	233.2	234.1	232.8	232.0	230.1	245.8	234.5
X. Shaft (to floor, excluding astragal)	743.3	741.9	744.3	748.1	751.5	733.3	744.3
Y. Minor Order	976.5	976.0	977.1	980.1	981.6	979.1	978.8

NAVE, EAST

Column Number:	EC 41	COL 24	COL 25	COL 26	COL 27	COL 28	COL 29	COL 30	COL 31	EC 50
Side of Column Measured:	a	b	b	b	b	b	b	b	b	c
A. Cornice Upper Projection	18.6	18.3	18.2	19.5	17.5	17.4	16.1	18.8	17.5	17.7
B. Cornice Crown Molding	20.2	19.1	18.6	20.4	22.3	18.6	19.7	19.6	18.9	17.7
C. Architrave (fascia 1)	13.8	13.6	13.7	13.2	13.9	13.3	13.8	13.1	13.4	13.7
D. Architrave (fascia 2)	11.8	12.1	12.4	12.2	12.0	12.1	11.7	12.7	10.3	12.5
E. Architrave (fascia 3)	11.7	11.4	11.5	11.6	12.6	11.8	11.6	11.8	10.3	11.9
F. Architrave (fascia 4)	11.6	9.0	10.6	9.2	11.2	9.2	11.8	11.6	10.4	11.5
G. Abacus	13.0	15.1	13.4	13.1	13.6	13.6	14.4	13.3	13.6	12.2
H. Volute	18.8	16.2	19.7	18.5	17.3	17.7	17.0	17.2	18.4	18.2
I. Acanthus Leaf (upper)	32.4	29.7	31.7	28.6	29.8	31.0	29.9	26.4	28.5	29.4
J. Acanthus Leaf (lower)	26.9	32.1	33.2	31.5	32.1	30.3	29.7	30.5	29.5	30.4
K. Astragal	5.6	5.8	5.4	5.5	5.6	5.8	5.7	6.3	6.1	5.2
L. Base	24.9	24.0	24.9	24.6	25.0	25.2	24.6	23.3	24.3	25.0
M. Plinth	19.8	19.4	19.5	19.3	17.4	18.0	17.9	18.9	18.8	18.3
N. Raised Foundation	0.7	0	0	0	0	0	0	0	0	0
O. Cornice	38.8	37.4	36.8	39.9	39.8	36.0	35.8	38.4	36.4	35.4
P. Frieze	51.8	50.5	51.8	49.5	47.7	49.0	50.5	52.0	53.6	52.8
Q. Architrave	48.7	45.8	48.0	46.0	49.2	46.0	48.9	49.1	44.7	49.1
R. Capital (including astragal)	95.0	97.4	97.7	94.8	96.4	97.5	94.7	92.3	93.7	94.0
S. Shaft Monolith (excluding astragal)	700.0	706.2	695.4	702.8	705.8	702.1	704.2	704.7	705.5	707.1
T. Base + Plinth + Raised Foundation	45.2	43.5	44.3	43.9	42.4	42.9	42.5	42.1	43.2	43.2
U. Entablature Block	139.8	133.3	136.5	135.6	136.7	131.0	135.3	139.7	134.8	137.5
V. Column	840.2	847.1	837.4	841.5	844.6	842.5	841.4	839.1	842.4	844.3
W. Capital + Entablature Block	234.8	230.7	234.2	230.4	233.1	228.5	230.0	232.0	228.5	231.5
X. Shaft (to floor, excluding astragal)	745.2	749.7	739.7	746.7	748.2	745.0	746.7	746.8	748.7	750.3
Y. Minor Order	980.0	980.4	973.9	977.1	981.3	973.5	976.7	978.8	977.2	981.8

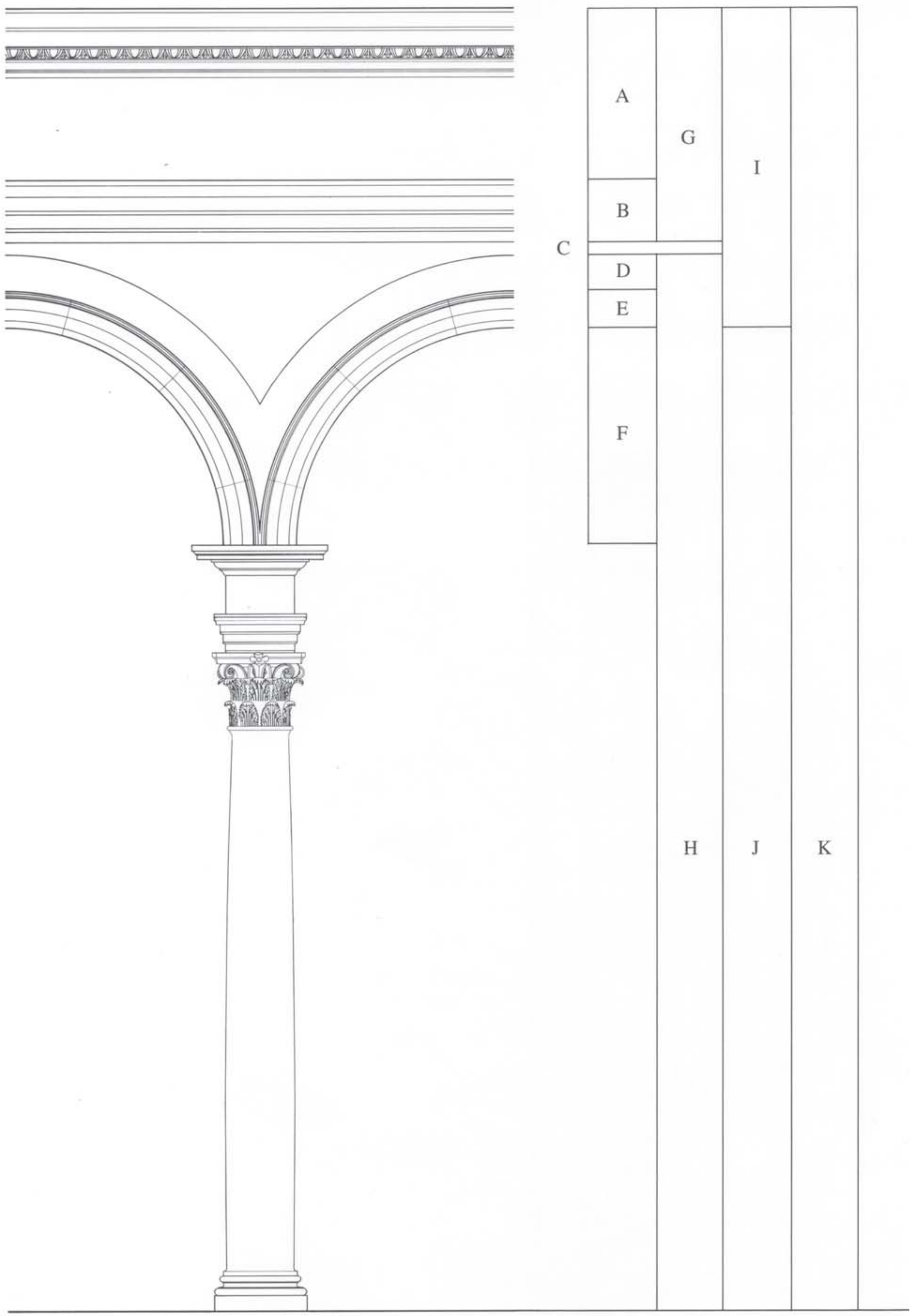
Santo Spirito Column Horizontal Dimensions

SANTO SPIRITO COLUMN HORIZONTAL DIMENSIONS										
All measurements in cm										
NAVE, WEST										
Column Number:	**EC 51**	**COL 1**	**COL 2**	**COL 3**	**COL 4**	**COL 5**	**COL 6**	**COL 7**	**COL 8**	**EC 10**
Side of Column Measured:	c	d	d	d	d	d	d	d	d	a
A. Springer or Arch Intradose Width	88.0	90.2	91.5	91.2	91.4	91.4	90.7	91.5	95.3	88.0
B. Cornice Width	167.7	170.8	169.0	167.9	169.1	171.8	171.8	166.9	170.2	165.5
C. Cornice Projection from Frieze	37.0	42.1	44.5	45.2	44.9	42.7	46.9	39.7	40.9	39.0
D. Frieze Width	87.8	88.0	88.0	88.0	87.8	88.0	87.4	87.9	87.9	87.9
E. Architrave Width (fascia 1)	117.4	113.4	113.5	113.6	116.0	116.9	115.8	116.6	112.1	117.2
F. Architrave Width (fascia 2)	103.2	99.7	99.5	99.4	102.4	102.9	101.7	101.1	100.8	102.8
G. Architrave Width (fascia 3)	96.5	92.6	93.0	92.3	95.4	95.8	94.4	95.0	94.8	96.0
H. Architrave Width (fascia 4)	88.4	85.4	86.5	84.4	88.0	88.0	86.3	88.2	88.0	88.0
I. Circumference at Widest Entasis	x	260.7	260.8	270.9	259.5	263.2	264.4	264.4	271.2	x
J. Diameter at Widest Entasis	x	83.0	83.0	86.2	82.6	83.8	84.2	84.2	86.3	x
K. Plinth Width	116.6	117.1	116.8	116.9	115.1	116.8	115.0	115.7	115.8	116.9
L. Engaged Column Plinth Projection (left)	43.7	x	x	x	x	x	x	x	x	43.8
L. Engaged Column Plinth Projection (right)	42.8	x	x	x	x	x	x	x	x	43.9
TRANSEPT, WEST										
Column Number:	**EC 11**	**COL 9**	**COL 10**	**COL 11**	**COL 12**	**COL 13**	**EC 20**			
Side of Column Measured:	b	c	d	d	a	a	b			
A. Springer or Arch Intradose Width	87.9	94.6	88.2	94.4	87.8	95.1	87.8			
B. Cornice Width	165.6	168.9	168.2	166.0	167.0	164.3	164.9			
C. Cornice Projection from Frieze	38.8	41.5	40.2	38.8	39.8	38.1	39.3			
D. Frieze Width	87.6	86.8	86.9	87.9	87.1	87.6	87.5			
E. Architrave Width (fascia 1)	116.7	113.2	114.7	117.2	115.5	115.7	116.6			
F. Architrave Width (fascia 2)	101.7	101.1	100.7	102.1	101.8	103.1	103.4			
G. Architrave Width (fascia 3)	94.9	94.9	93.5	95.1	94.5	95.2	96.5			
H. Architrave Width (fascia 4)	87.1	88.0	87.5	87.7	87.4	87.5	87.6			
I. Circumference at Widest Entasis	x	269.0	252.4	252.4	262.8	254.0	x			
J. Diameter at Widest Entasis	x	85.6	80.3	80.3	83.7	80.9	x			
K. Plinth Width	116.8	114.2	113.6	116.8	117.1	116.1	116.8			
L. Engaged Column Plinth Projection (left)	43.4	x	x	x	x	x	44.4			
L. Engaged Column Plinth Projection (right)	44.4	x	x	x	x	x	44.1			
TRANSEPT, NORTH										
Column Number:	**EC 21**	**COL 14**	**COL 15**	**COL 16**	**COL 17**	**COL 18**	**EC 30**			
Side of Column Measured:	c	d	d	a	b	b	c			
A. Springer or Arch Intradose Width	88.1	96.1	87.7	96.5	87.8	96.2	87.7			
B. Cornice Width	163.9	164.3	166.0	161.8	166.8	165.8	166.2			
C. Cornice Projection from Frieze	39.8	37.8	39.2	37.7	40.1	38.7	39.2			
D. Frieze Width	87.0	87.6	86.9	86.9	86.5	87.3	87.5			
E. Architrave Width (fascia 1)	114.0	115.5	114.3	115.8	113.9	116.4	117.0			
F. Architrave Width (fascia 2)	101.2	101.0	99.2	99.5	100.3	102.0	103.7			
G. Architrave Width (fascia 3)	93.7	94.0	92.2	92.6	93.8	94.9	95.9			
H. Architrave Width (fascia 4)	86.0	87.7	87.2	87.0	87.8	87.2	87.8			
I. Circumference at Widest Entasis	x	264.5	259.1	258.2	263.2	266.5	x			
J. Diameter at Widest Entasis	x	84.2	82.5	82.2	83.8	84.8	x			
K. Plinth Width	116.9	117.0	117.0	117.1	117.1	114.0	116.2			
L. Engaged Column Plinth Projection (left)	44.2	x	x	x	x	x	44.4			
L. Engaged Column Plinth Projection (right)	44.0	x	x	x	x	x	44.4			

SANTO SPIRITO COLUMN HORIZONTAL DIMENSIONS, continued										
All measurements in cm										
TRANSEPT, EAST										
Column Number:	EC 31	COL 19	COL 20	COL 21	COL 22	COL 23	EC 40			
Side of Column Measured:	d	a	b	b	b	c	d			
A. Springer or Arch Intradose Width	88.0	94.2	88.2	91.0	88.3	93.7	87.8			
B. Cornice Width	166.0	170.6	174.0	165.8	164.8	170.6	162.7			
C. Cornice Projection from Frieze	38.5	41.5	43.4	38.6	38.7	41.4	35.3			
D. Frieze Width	87.5	87.8	86.3	87.7	87.0	86.9	87.5			
E. Architrave Width (fascia 1)	115.4	114.3	116.3	116.4	115.8	112.9	116.5			
F. Architrave Width (fascia 2)	102.6	99.8	101.9	101.6	100.5	99.2	102.7			
G. Architrave Width (fascia 3)	95.3	93.1	94.9	95.9	94.4	93.4	95.8			
H. Architrave Width (fascia 4)	87.7	85.9	87.0	88.1	86.0	87.0	87.4			
I. Circumference at Widest Entasis	x	256.3	255.7	268.7	264.8	257.7	x			
J. Diameter at Widest Entasis	x	81.6	81.4	85.5	84.3	82.0	x			
K. Plinth Width	116.9	114.4	115.0	116.9	114.8	114.7	116.9			
L. Engaged Column Plinth Projection (left)	43.9	x	x	x	x	x	44.3			
L. Engaged Column Plinth Projection (right)	44.0	x	x	x	x	x	44.1			
NAVE, EAST										
Column Number:	EC 41	COL 24	COL 25	COL 26	COL 27	COL 28	COL 29	COL 30	COL 31	EC 50
Side of Column Measured:	a	b	b	b	b	b	b	b	b	c
A. Springer or Arch Intradose Width	88.2	91.4	88.3	90.3	91.5	91.1	91.8	89.9	89.4	88.0
B. Cornice Width	166.9	171.0	166.5	166.4	164.8	165.5	165.5	166.6	166.6	169.6
C. Cornice Projection from Frieze	38.7	41.4	39.9	40.4	38.4	38.6	38.6	38.9	38.1	37.3
D. Frieze Width	87.9	87.6	87.9	87.0	87.0	87.3	87.6	88.0	87.9	88.0
E. Architrave Width (fascia 1)	116.9	116.7	112.8	111.4	115.0	116.4	115.5	115.8	116.1	117.5
F. Architrave Width (fascia 2)	103.0	102.5	100.1	98.4	100.6	101.8	100.2	101.6	101.8	103.5
G. Architrave Width (fascia 3)	95.9	95.6	93.7	92.2	93.7	94.9	93.8	95.0	94.8	96.5
H. Architrave Width (fascia 4)	87.9	87.8	87.9	85.5	85.6	86.9	87.0	86.7	88.0	88.3
I. Circumference at Widest Entasis	x	264.8	264.4	277.6	280.9	276.4	276.8	276.0	279.4	x
J. Diameter at Widest Entasis	x	84.3	84.2	88.4	89.4	88.0	88.1	87.9	88.9	x
K. Plinth Width	116.8	113.8	117.3	117.0	115.5	113.2	115.3	116.5	114.9	117.2
L. Engaged Column Plinth Projection (left)	44.3	x	x	x	x	x	x	x	x	43.1
L. Engaged Column Plinth Projection (right)	44.2	x	x	x	x	x	x	x	x	44.0

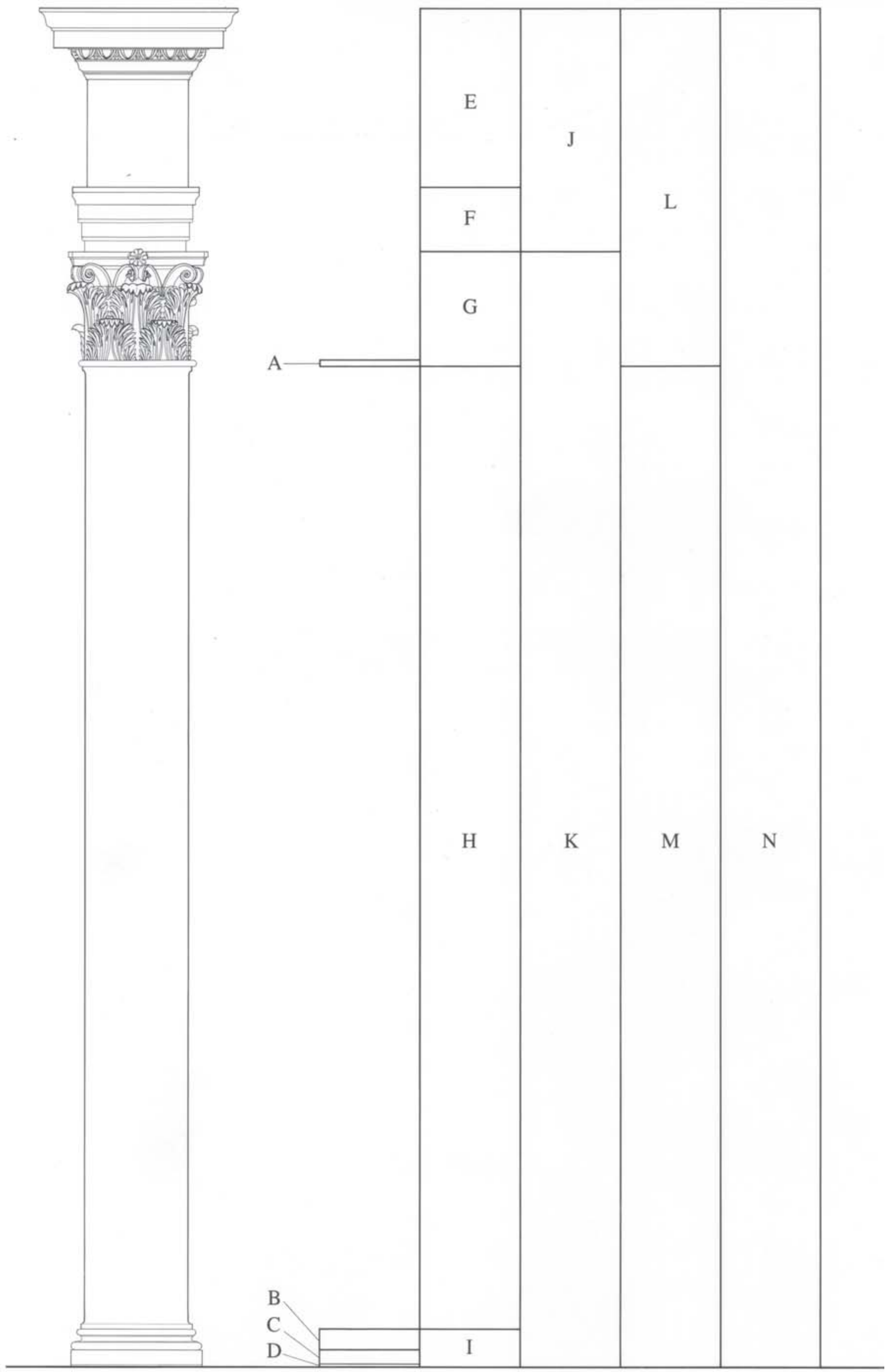
Santo Spirito Bay Horizontal Dimensions

SANTO SPIRITO BAY HORIZONTAL DIMENSIONS									
All Measurements in cm									
NAVE, WEST									
Bay Number:	**EC 51—1**	**1—2**	**2—3**	**3—4**	**4—5**	**5—6**	**6—7**	**7—8**	**8—EC 10**
A. Arch Diameter	x	550.7	550.3	549.2	549.1	549.9	549.6	548.4	x
B. On Center	x	641.6	641.7	640.5	640.5	640.9	640.7	641.8	x
C. In the Clear	x	558.6	557.1	556.1	557.3	556.9	556.5	556.5	x
D. In the Clear, Farther Shaft Surfaces	x	724.6	726.3	724.9	723.7	724.9	724.9	727.0	x
E. Plinth to Plinth	524.4	524.6	524.8	524.5	524.5	525.0	525.3	526.0	473.7
F. Plinth to Plinth, Farther Edges	x	758.5	758.5	756.5	756.4	756.8	756.0	757.5	x
TRANSEPT, WEST									
Bay Number:	**EC 11—9**	**9—10**	**10—11**	**11—12**	**12—13**	**13—EC 20**			
A. Arch Diameter	x	552.9	553.6	552.6	553.6	x			
B. On Center	x	644.3	644.9	643.7	645.0	x			
C. In the Clear	x	561.4	564.6	561.7	562.7	x			
D. In the Clear, Farther Shaft Surfaces	x	727.3	725.2	725.7	727.3	x			
E. Plinth to Plinth	471.2	530.4	529.7	526.7	528.4	470.1			
F. Plinth to Plinth, Farther Edges	x	758.2	760.1	760.6	761.6	x			
TRANSEPT, NORTH									
Bay Number:	**EC 21—14**	**14—15**	**15—16**	**16—17**	**17—18**	**18—EC 30**			
A. Arch Diameter	x	553.3	553.7	553.3	553.5	x			
B. On Center	x	645.2	645.8	645.4	645.5	x			
C. In the Clear	x	561.9	563.4	562.4	561.2	x			
D. In the Clear, Farther Shaft Surfaces	x	728.6	728.1	728.4	729.8	x			
E. Plinth to Plinth	470.3	528.2	528.7	528.3	529.9	470.1			
F. Plinth to Plinth, Farther Edges	x	762.2	762.8	762.5	761.0	x			
TRANSEPT, EAST									
Bay Number:	**EC 31—19**	**19—20**	**20—21**	**21—22**	**22—23**	**23—EC 40**			
A. Arch Diameter	x	552.4	555.7	555.5	554.3	x			
B. On Center	x	643.6	645.3	645.2	645.3	x			
C. In the Clear	x	562.1	561.8	560.3	562.1	x			
D. In the Clear, Farther Shaft Surfaces	x	725.1	728.7	730.1	728.4	x			
E. Plinth to Plinth	474.5	528.9	529.3	529.3	530.5	473.8			
F. Plinth to Plinth, Farther Edges	x	758.3	761.2	761.0	760.0	x			
NAVE, EAST									
Bay Number:	**EC 41—24**	**24—25**	**25—26**	**26—27**	**27—28**	**28—29**	**29—30**	**30—31**	**31—EC 50**
A. Arch Diameter	x	556.2	556.1	550	550.1	551.3	551.8	555.2	x
B. On Center	x	646.1	645.4	640.9	641.4	642.8	642.6	644.8	x
C. In the Clear	x	561.8	559.1	552.0	552.7	554.7	554.6	556.4	x
D. In the Clear, Farther Shaft Surfaces	x	730.3	731.7	729.8	730.1	730.8	730.6	733.2	x
E. Plinth to Plinth	468.0	530.5	528.2	524.6	527.0	528.5	526.7	529.1	525.4
F. Plinth to Plinth, Farther Edges	x	761.6	762.5	757.1	755.7	757.0	758.5	760.5	x



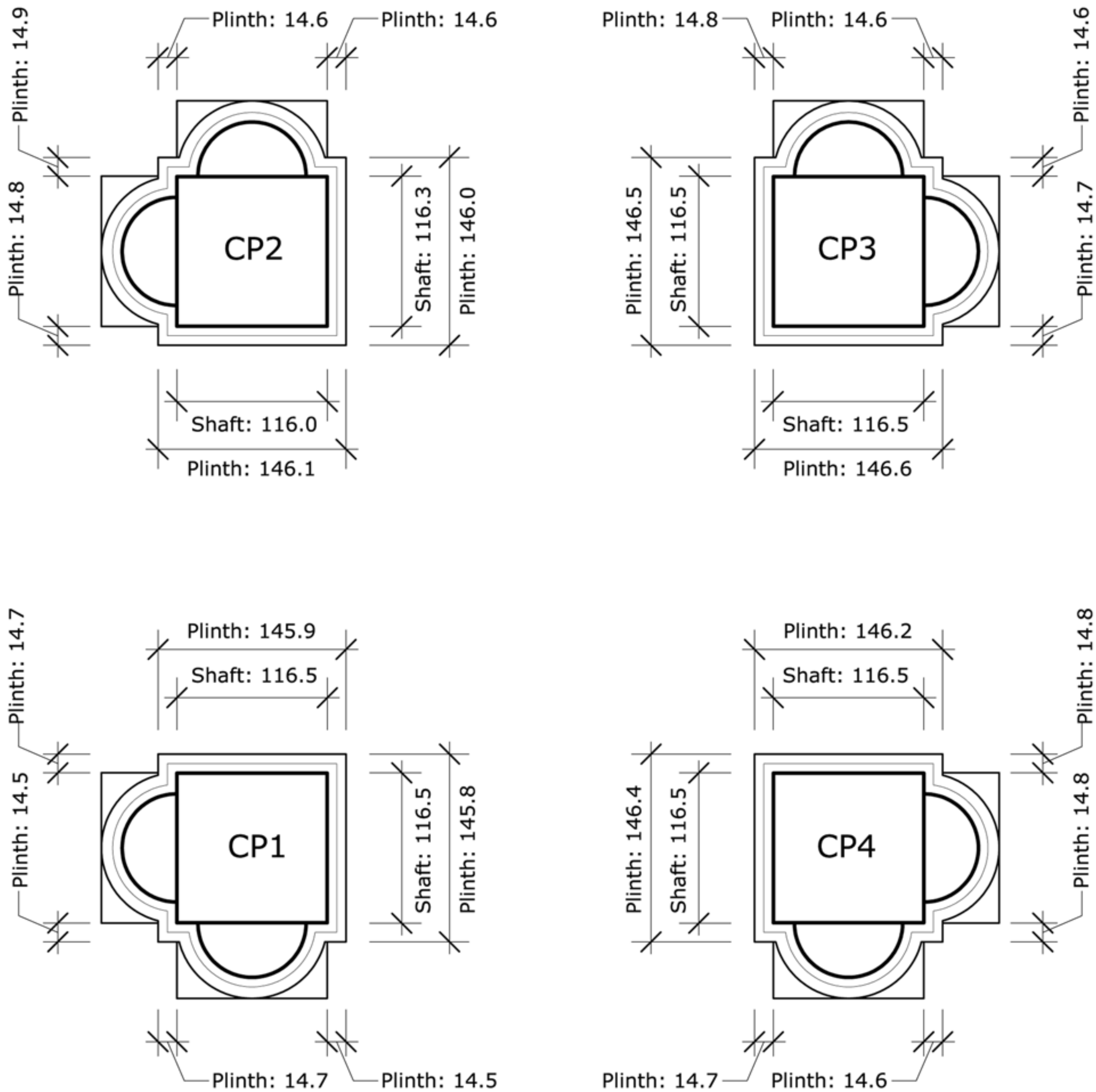
Santo Spirito Arch and Upper Entablature Vertical Dimensions

SANTO SPIRITO ARCADE ARCH AND UPPER ENTABLATURE VERTICAL DIMENSIONS									
All measurements in cm									
NAVE, WEST									
Bay Number:	**EC51—1**	**1—2**	**2—3**	**3—4**	**4—5**	**5—6**	**6—7**	**7—8**	**8—EC10**
A. Cornice + Frieze	217.1	216.3	218.2	218.5	216.8	215.2	212.7	215.0	216.9
B. Architrave	76.3	77.8	77.6	76.9	77.1	77.9	77.7	77.9	77.5
C. Gap Below Architrave	22.4	20.2	13.8	16.6	15.5	16.7	15.2	13.9	17.2
D. Archivolt "Shadow"	48.3	44.6	44.6	44.4	44.6	45.6	45.6	47.0	44.6
E. Archivolt	48.0	48.3	48.2	48.3	47.9	47.5	48.3	47.9	48.7
F. Arch Radius	277.2	276.9	276.7	274.8	278.9	276.1	275.5	277.1	278.0
G. Entablature	293.4	294.1	295.8	295.4	293.9	293.1	290.4	292.9	294.4
H. Top of Archivolt "Shadow" to Floor	1353.6	1352.0	1353.7	1349.9	1352.0	1350.5	1352.7	1351.8	1347.9
I. Entablature + Gap + Archivolt	412.0	407.2	402.4	404.7	401.9	402.9	399.5	401.7	404.9
J. Arch Intradose to Floor	1257.3	1259.1	1260.9	1257.2	1259.5	1257.4	1258.8	1256.9	1254.6
K. Total Height of Major Order	1669.3	1666.3	1663.3	1661.9	1661.4	1660.3	1658.3	1658.6	1659.5
TRANSEPT, WEST									
Bay Number:	**EC11—9**	**9—10**	**10—11**	**11—12**	**12—13**	**13—EC20**			
A. Cornice + Frieze	216.0	216.3	216.2	212.5	212.9	214.5			
B. Architrave	76.3	76.9	77.3	77.5	76.3	76.7			
C. Gap Below Architrave	20.9	19.8	19.4	20.8	18.9	20.2			
D. Archivolt "Shadow"	45.2	45.8	45.8	44.9	44.7	44.8			
E. Archivolt	48.9	47.8	48.1	47.5	48.0	47.9			
F. Arch Radius	274.8	276.1	275.2	273.9	275.5	276.6			
G. Entablature	292.3	293.2	293.5	290.0	289.2	291.2			
H. Top of Archivolt "Shadow" to Floor	1346.4	1346.9	1347.3	1345.8	1346.3	1344.0			
I. Entablature + Gap + Archivolt	407.3	406.5	406.8	403.2	400.8	404.1			
J. Arch Intradose to Floor	1252.3	1253.3	1253.5	1253.4	1253.6	1251.3			
K. Total Height of Major Order	1659.6	1659.8	1660.2	1656.6	1654.4	1655.4			
TRANSEPT, NORTH									
Bay Number:	**EC21—14**	**14—15**	**15—16**	**16—17**	**17—18**	**18—EC30**			
A. Cornice + Frieze	214.7	212.6	213.8	213.6	212.3	214.1			
B. Architrave	77.3	77.4	77.1	76.9	77.2	76.9			
C. Gap Below Architrave	18.7	18.3	14.0	15.9	13.9	16.5			
D. Archivolt "Shadow"	46.3	45.0	45.2	45.2	45.5	45.3			
E. Archivolt	47.6	47.8	48.0	48.1	47.9	47.7			
F. Arch Radius	276.3	278.4	281.3	275.7	277.9	278.5			
G. Entablature	292.0	290.0	290.9	290.5	289.5	291.0			
H. Top of Archivolt "Shadow" to Floor	1345.5	1348.5	1352.4	1350.3	1353.1	1349.5			
I. Entablature + Gap + Archivolt	404.6	401.1	398.1	399.7	396.8	400.5			
J. Arch Intradose to Floor	1251.6	1255.7	1259.2	1257.0	1259.7	1256.5			
K. Total Height of Major Order	1656.2	1656.8	1657.3	1656.7	1656.5	1657.0			
TRANSEPT, EAST									
Bay Number:	**EC31—19**	**19—20**	**20—21**	**21—22**	**22—23**	**23—EC40**			
A. Cornice + Frieze	212.7	212.9	214.7	214.9	215.9	215.7			
B. Architrave	78.2	76.7	76.4	77.5	77.8	78.9			
C. Gap Below Architrave	22.5	24.0	20.9	17.0	14.5	17.5			
D. Archivolt "Shadow"	45.1	44.7	46.1	45.8	45.6	45.6			
E. Archivolt	48.3	47.6	47.6	47.1	48.5	48.1			
F. Arch Radius	274.6	276.0	275.3	276.9	276.9	275.2			
G. Entablature	290.9	289.6	291.1	292.4	293.7	294.7			
H. Top of Archivolt "Shadow" to Floor	1344.2	1344.8	1347.6	1350.6	1351.3	1347.7			
I. Entablature + Gap + Archivolt	406.8	405.9	405.7	402.3	402.3	405.7			
J. Arch Intradose to Floor	1250.9	1252.5	1253.9	1257.7	1257.2	1254.1			
K. Total Height of Major Order	1657.6	1658.4	1659.6	1660.0	1659.5	1659.8			
NAVE, EAST									
Bay Number:	**EC41—24**	**24—25**	**25—26**	**26—27**	**27—28**	**28—29**	**29—30**	**30—31**	**31—EC50**
A. Cornice + Frieze	220.4	219.7	221.2	222.4	221.8	223.9	222.4	222.1	224.2
B. Architrave	77.9	77.6	76.3	76.7	77.5	77.4	77.7	78.3	76.8
C. Gap Below Architrave	17.5	20.6	22.8	15.6	19.5	22.5	18.5	18.7	17.8
D. Archivolt "Shadow"	45.7	44.8	46.4	45.0	45.5	45.4	44.4	45.5	45.2
E. Archivolt	48.2	48.5	47.6	48.6	48.0	48.3	48.8	48.5	47.3
F. Arch Radius	274.2	277.1	277.5	279.0	275.5	271.9	275.1	275.6	278.6
G. Entablature	298.3	297.3	297.4	299.0	299.3	301.3	300.1	300.4	301.0
H. Top of Archivolt "Shadow" to Floor	1348.3	1347.4	1346.9	1351.8	1346.3	1340.7	1346.0	1347.6	1350.6
I. Entablature + Gap + Archivolt	409.7	411.1	414.2	408.2	412.2	417.5	411.8	413.1	411.3
J. Arch Intradose to Floor	1254.4	1254.2	1253.0	1258.2	1252.9	1247.0	1252.8	1253.6	1258.1
K. Total Height of Major Order	1664.1	1665.3	1667.2	1666.3	1665.0	1664.5	1664.6	1666.7	1669.4



Santo Spirito Crossing Pilaster Vertical Dimensions

SANTO SPIRITO CROSSING PILASTER VERTICAL DIMENSIONS								
All measurements in cm								
Crossing Pier Number:	**CP1**	**CP1**	**CP2**	**CP2**	**CP3**	**CP3**	**CP4**	**CP4**
Side of Crossing Pier Measured:	**c**	**d**	**a**	**d**	**a**	**b**	**b**	**c**
A. Astragal	6	x	5.6	5.6	5.9	5.8	x	7.0
B. Base	24.8	x	24.8	24.8	24.9	25.0	x	24.4
C. Plinth	19	x	19.9	20.2	19.0	18.7	x	19.3
D. Raised Foundation	1.7	x	1.0	1.3	0	0	x	0
E. Cornice + Frieze	216.1	x	214.2	214.9	213.2	212.8	x	216.9
F. Architrave	78.8	x	77.4	77.5	79.3	79.7	x	77.3
G. Capital (including astragal)	134.1	x	133.3	132.9	135.9	135.3	x	133.8
H. Shaft (excluding astragal)	1186.7	x	1185.8	1185.1	1185.4	1185.6	x	1188.7
I. Base + Plinth + Raised Foundation	45.2	x	45.4	45.7	43.8	43.7	x	43.8
J. Entablature	294.8	x	291.6	292.4	292.5	292.5	x	294.2
K. Pilaster Height	1366.0	x	1364.5	1363.7	1365.1	1364.6	x	1366.3
L. Entablature + Capital	428.9	x	424.9	425.3	428.4	427.8	x	428.0
M. Top of Shaft to Floor	1231.9	x	1231.2	1230.8	1229.2	1229.3	x	1232.5
N. Total Order Height	1660.8	x	1656.1	1656.1	1657.6	1657.1	x	1660.5



Santo Spirito Crossing Pilaster (Pier) Horizontal Dimensions

8.4 Statistical Analysis

One of the underlying assumptions of Chapter 3 of this study is that all the nave arcade bays were intended to be dimensionally identical. They cannot be identical, however, for dimensional variations from one bay to the next are inevitable. We therefore face the problem of deciding which bays to use in our proportional analysis. The masons may have intended one set of dimensions for all the nave arcade bays, but they gave us sixteen individual sets to choose from. Even after we eliminate the five easternmost bays of the nave (ten individual nave arcade bays) from dimensional consideration due to their notably lower quality of execution compared with the westernmost three bays (see Figure 2-1; and Chapter 2, sections 2.2 and 2.3), we are still left with six individual nave arcade bays to choose from. The most logical solution might seem to be to take the average dimensions of all six bays. Proportional calculations based on averages, however, are unreliable because averages do not account for mathematically significant conditions within the data, such as systematic error, or wide dispersion of extremes. The next most logical solution might seem to be to base our proportional analysis on the dimensions of one representative bay selected at random. By this approach, however, we would run the risk of selecting the one bay that least accurately represents the proportions the masons intended; or, conversely, we might tend to choose the one bay that best supports a particular hypothesis of interest to us—and indeed, the very possibility of such a bias would call into question the objectivity of the entire investigation. Finally, we might propose to undertake separate proportional calculations for each nave arcade bay. This approach, however, would execerbate rather than mitigate the problem at hand, for we would then have, in addition to six sets of measurements to choose from, six sets of proportional calculations as well.

Once we resolve the problem of how to calculate the proportions of dimensionally non-identical nave arcade bays, we must confront the problem of how to interpret these calculations—i.e., how to correlate the degree of dimensional consistency from one bay to the next, with the degree of precision with which particular proportions correspond to those measurements. How closely, for example, must the proportion $1{:}\sqrt{2}$ correspond to the true width-to-height proportions of each nave arcade bay, according to the points of measurement shown in Figure 2-2, for us to consider that proportion a likely reflection of the masons' intentions? Arbitrary evaluation of quantitative data, such as the establishment of, say, plus-or-minus 5% as an acceptable tolerance level for proportional calculations made from building measurements, simply because such a figure intuitively seems appropriate, undercuts the mathematical advantages of recording precise measurements at all.[1]

The best strategy for resolving these problems, albeit an imperfect one, is to turn to the science of statistics. At the simplest level of analysis, statistics can be descriptive. Calculating the "standard deviation," for example, measures the dispersion of data relative to the mean. The lower the standard deviation, the more closely clustered are the magnitudes of the measurements around the mean. We thus have a quantitative basis for evaluating dimensional variations within a set of repeating dimensions. Our task at San Lorenzo, however, is less one of describing the survey data *per se*, than of evaluating inferences we would like to draw from them. Such inferences involve multiple layers of uncertainty, due to the unknown measurement and construction errors embedded in the data. Because of these uncertainties, our proportional analysis must be expressed in the non-definitive terms of confidence, probability, and ranges of values.

A computer spread sheet program designed for this study gives us a mechanism for quantitatively testing proportional hypotheses.[2] It does so by ruling out proportional values that do not fall within calculated ranges, based on a confidence level that we choose. This spread sheet program takes into account assumed estimates for construction and measurement error, and thus provides the most accurate possible estimates of the nave arcade bay proportions, in light of the bay-by-bay variations in the arcade measurements that we have observed.[3] The use of a spread sheet program such as this in a study of architectural proportion has two notable limitations: First, the numbers of nave arcade bays that we can examine at San Lorenzo—fourteen, if we consider the full nave, or six, if we consider only the earlier nave construction phase—are not truly statistical populations. Ideally, hundreds of repeating elements at a minimum should be analyzed. Second, statistical analysis is best applied to data that is not subject to the whims of human nature. Variations in mass-produced machine tool dimensions, for example, would be more conducive to statistical analysis than six (or fourteen) column heights, which might exhibit variation simply because an otherwise careful mason happened to be having a bad day. Nevertheless, the computerized analysis presented here is useful when treated as one component in a range of documentary and observation-based historical evidence, all of which must be evaluated critically.

Let us consider an example of how the statistical spread sheet works. In Chapter 2, I note that a dual diagon can be inscribed within each nave arcade bay, measured plinth-to-plinth in width, and from the floor to the tops of the entablature blocks in height (Figure 2-34). The spread sheet requires that we enter all the height and width measurements of interest into the "numerator" and "denominator" cells, and that we choose a "confidence level" (Figure 8.4-1).[4] It then calculates the standard deviation for each set of width and height measurements per bay, and uses these figures to calculate an upper and lower limit of a "probable proportion range" within which the proportion intended by the masons is assumed to fall.[5] The greater the confidence level, the farther apart the limits of the probable proportion range will be. In other words, the more certainty we demand of our findings, the broader will be the range of proportions that we will have to consider. Statisticians typically choose a confidence level of 95%.

Let us first analyze my dual diagon hypothesis based on the measurements from all sixteen nave arcade bays. We enter the plinth-to-plinth distances and total order heights into the appropriate cells and, based on a confidence level of 95%, the spread sheet calculates a confidence interval of 1:1.812 to 1:1.827 (Figure 8.4-1). Since the dual diagon proportion, 1:1.828… (or, $2\sqrt{2}-1$), falls outside this range (albeit just barely), we may state with 95% certainty that the spread sheet has rejected this proportion, and, therefore, that the masons did not intend to use it here. Of course, there is a 5% chance that the results of this calculation are incorrect—i.e., that the masons intended this proportion after all. We cannot eliminate this uncertainty. If we enter a higher confidence level into the spread sheet, say, 99%, the probable proportion range increases to 1.809 to 1.830 (Figure 8.4-2). The dual diagon proportion now falls *inside* the interval, but so do many others; and due to this greater inclusiveness, the test becomes less effective at screening out the proportions the masons did *not* intend.

Due to the nature of statistical studies, the probable proportion range can only be used to *reject* proportions that do not fall within it. It cannot be used as evidence that a particular proportion that falls within it is more likely to have been intended by the masons than one that falls outside of it. Nevertheless, since the proportions the masons intended will presumably fall within the range, the more proportions that fall *outside* it, the better, so that we can begin to isolate the intended proportions—provided, of course, that intentional proportions exist here at all. In short, we need to maximize our certainty (the confidence level), while minimizing the range of possible proportions (the probable proportion range). In this effort, our observations regarding the construction history of the nave arcades provide a significant advantage, as we will now see.

A mediator between the confidence level and the probable proportion range is the standard deviation. Generally, the lower the standard deviation, the narrower the probable proportion range for a given confidence level will be. Thus, had the masons built the basilica of San Lorenzo with greater care, the dimensional irregularities would presumably be fewer and smaller, the standard deviation would be lower, and the probable proportion range would be narrower relative to the confidence level. We would therefore be able to reject a broader range of proportions as candidates for the ones the masons intended, and we would be able to do so with a high degree of confidence. Although we cannot go back in time and implore the masons to be more careful, Cosimo's apparent demands for speedy completion of work notwithstanding, there is of course another way to significantly reduce the standard deviation: we can limit our data to the measurements of the more carefully-constructed western portion of the nave.

Returning now to our dual diagon test, and eliminating the ten easternmost nave arcade bays from consideration, the standard deviation of the total order height drops substantially, from 2.32 cm. (Figure 8.4-1) to 0.57 cm. (Figure 8.4-3), and that of the plinth-to-plinth distance, from 4.24 cm. (Figure 8.4-1) to 0.45 cm. (Figure 8.4-3). More importantly, the probable proportion range narrows from 1:1.812–1:1.827 (Figure 8.4-1) to 1:1.824–1:1.827 (Figure 8.4-3). As it turns out, eliminating the measurements of the ten easternmost nave arcade bays does not affect the upper limit of the probable proportion range, which remains at 1:1.827. Thus, with the confidence level maintained at 95%, even these revised spread sheet calculations reject the dual diagon proportion. With the confidence level increased to 99%, however, this proportion falls within the probable proportion range (Figure 8.4-4), as it did when we considered the measurements of all sixteen nave arcade bays at this confidence level (Figure 8.4-2). This time, however, the probable proportion range seems to be quite narrow, at 1:1.823—1: 1.828 (Figure 8.4-4). How are we to interpret these results?

First we must note that we are now dealing with exceedingly small tolerances. If each total order height were to measure just 0.5 cm. (0.05%) taller than it does at present, the dual diagon proportion would fall within the confidence intervals in all four of the preceding tests. Such a small and consistent insufficiency in the heights of the orders could be the result of mortar shrinkage. In each order there are eight mortar joints (nine in the case of Col. 4; see Chapter 2, sections 2.2 and 2.3), and each would have had to shrink by slightly less than one millimeter to account for this shortfall—a reasonable estimate for mortar joint shrinkage in medieval construction.[6] Thus, for now let us simply consider the dual diagon hypothesis to be a promising one, and defer final judgement of its merit until we have completed similar spread sheet tests for the other proportions in the nave arcade bay that appear to be related to it both geometrically and historically.

For our next spread sheet test, let us return to our very first proportional observation, the comparison of the plinth-to-plinth distances in each nave arcade bay, measured first between the nearer edges of the column plinths, and then between the farther edges. Note that the measurements of the two nave arcade bays nearest the crossing square cannot be included in this test because each terminates with a pilaster on the west side. Thus, the second plinth-to-plinth measurement in question (taken between the farther edges of the column plinths) is not found in these bays. Based on the measurements of the remaining four nave arcade bays that date to the earlier nave construction phase, we find very low standard deviations of 0.17 cm. and 0.19 cm., and a probable proportion range of 1:1.413—1:1.414 (Figure 8.4-5). This test result could not be more supportive of my root-2 rectangle hypothesis, which calls for a proportion of 1:1.414… (1:√2).

When we next test how closely the height of a root-2 rectangle, inscribed between each pair of adjacent column plinths, corresponds to the heights of the column shafts, however, the results are less encouraging (Figure 8.4-6). The standard deviations of approximately 0.5 cm. indicate that the column shaft heights and intercolumniations were executed with great consistency from one to the next, thus making ambiguous test results unlikely, and the very narrow probable proportion range of 1:1.433—1:1.436 would seem to definitively exclude the root-2 rectangle proportion of 1:1.414… (1:√2) as an accurate description of the proportions of the nave arcade bays, when measured plinth-to-plinth. Indeed, the discrepancy represents approximately 11-12 cm. of excess column shaft height, which is quite substantial when we observe that the maximum height difference between any two column shafts within the western six nave arcade bays is just 1.5 cm.[7] When we next test how closely the height of a square, circumscribed about the farther edges of adjacent column plinths, corresponds to the heights of the column shafts (Figure 80), we obtain similar results. For a true square, the upper and lower ends of the probable proportion range should both be 1. Instead, both are slightly larger, indicating excess column shaft heights of approximately 11-12 cm.

In order to interpret the preceding four test results correctly, we must now clarify one important distinction, already implicit in this discussion: These tests help us to identify the *masons'* intentions, not necessarily the architect's intentions. After all, if the masons could make all the column shafts consistent in height, with a maximum variation of 1.5 cm., we may assume that they could also make each column shaft conform to the height dimension they intended within the same tolerance. Thus, judging from the preceding tests, the masons appear to have intended to execute the dual diagon proportion and the 1:√2 relationship between the two plinth-to-plinth dimensions that we examined in the first two tests; but neither the root-2 rectangle nor the square examined in the last two tests. We need not come to the same conclusion with regard to the *architect's* intentions, however. We have seen that Brunelleschi's involvement with the basilica probably ended by early 1429 (modern style), or, nearly two decades before construction of the nave arcades began—ample time for his specifications for the nave arcade proportions to have become corrupted before finding their way into the masons' hands. The masons may not have intended the overlapping square and root-2 rectangle to align with the tops of the column shafts (Figure 2-2), but did Brunelleschi?[8]

The three criteria that we established earlier for the purpose of evaluating the likelihood that particular proportions reflect the *architect's* intentions, now come crucially into play (see Chapter 2, section 2.1). The first criterion, let us recall, emphasizes the spread sheet test as the fundamental standard for evaluation, but allows for flexibility in the interpretation of this test if a convincing explanation for dimensional discrepancies can be found through historical research. Since the four proportional relationships examined in the preceding tests are closely interrelated, and since two of them conform to the measurements within—or very nearly within—the accuracy level established by the tests, the failure of the other two (the root-2 rectangle and the square) to similarly conform, by a significant 11-12 cm., seems likely to be the result of an error brought about by some historical circumstance, yet to be identified.

In order to continue toward our objective of identifying the proportions Brunelleschi intended for the nave arcades, we will temporarily ignore these 11-12 cm. discrepancies. Doing so will allow us to focus on the second and third of our evaluation criteria, which are concerned with discovering the particular historical contexts within which any set of intentional, rather than coincidental, proportions would likely be situated. We can then revisit the column shaft height discrepancies, and attempt to determine their cause (see Chapter 2, section 2.7).

Before we proceed to these context studies, however, which will explore the subjects of geometry, number, and arithmetic as they relate to our hypothesis, a word about other proportional possibilities is in order. Thus far we have examined only one interpretation of the proportions of the San Lorenzo nave arcade bays, because it is the only one to show serious promise as a likely reflection of the architect's intentions. This hypothesis consists of three overlapping geometrical figures—the square, the root-2 rectangle, and the dual diagon—all of which can be described in terms of the four proportional relationships tested above. Although other scholars have provided alternative interpretations of the proportions of the San Lorenzo nave arcade bays, none of them meet the three criteria established for this study. Saalman's proposal, for example, that each bay of the nave arcades conforms to the proportions of a root-5 rectangle inscribed in the clear (i.e., between adjacent column shafts) in width, and from floor level to the undersides of the arches in height, fails to satisfy Criterion #1 (see Chapter 2, section 2.1), for it fails to meet the requirements of the spread sheet test by approximately 5-7 cm. It furthermore fails to warrant the exception allowed under Criterion #1, because it neither appears in documentary sources relevant to the early fifteenth century (Criterion #2), nor does it appear to have any significant relationship to other proportions in the basilica (Criterion #3).[9] The same may be said of numerous other potential proportional hypotheses, whether based on geometrical or modular proportions. My methodology, therefore, which combines rigorous observation-based and documentary analysis, helps to keep our attention focused on the historically most likely proportions, and away from the unproductive distractions offered by the many potential coincidental proportions that inevitably compete for our attention.

[1] See, for example, the following arbitrary tolerances established by Saalman: “Any suggested proportional relationship must be demonstrable in carefully surveyed measurements of the buildings involved, with a tolerance of no more than 15 cm in large dimensions and no tolerance at all in small dimensions. A small margin of error in laying out or surveying dimensions from 5 to 40 metres cannot be excluded. In dimensions up to 2 metres no tolerance is permissible. Between 2 and 5 metres discrepancies of perhaps 2 cm may be allowed.” (Howard Saalman, *Filippo Brunelleschi: The Buildings*, University Park, Pennsylvania, 1993, p. 361).

[2] The spread sheet program was designed by James E. Georges of Statistics Unlimited, Inc., Wellesley Hills, Massachusetts. I thank Mr. Georges, as well as Stephen Blyth, Department of Mathematics, Imperial College of Science, Technology & Medicine, London, who generously provided additional advice.

[3] The standard deviations give estimates of the combined measurement and construction error. If the measurements are normally distributed, which is one of our assumptions, 95% of all measurements should be within two standard deviations above and two standard deviations below the mean.

[4] Since each bay contains one width dimension but two height dimensions, one for each total order height measured at each column, I have entered the average total order height for each bay into the spread sheet. Since the spread sheet can accommodate only one numerator and one denominator, and since only two numerator (height) measurements are involved, in this case my use of the average is mathematically appropriate.

[5] The spread sheet formulae are as follows: For the mean of both numerator and denominator: =AVERAGE(R[-15]C:R[-2]C); for the standard deviation of both numerator and denominator: = STDEV(R[-16]C:R[-3]C); for the lower limit of the probable proportion range: =(-B-SQRT(B^2-4*A*C_))/2/A; and for the lower limit of the probable proportion range: (-B+SQRT(B^2-4*A*C_))/2/A. According to James E. Georges (see n. 123, above) these calculations are based on Fieller’s Theorem, as discussed in: E. C. Fieller, “Some Problems in Interval Estimation,” *Journal of the Royal Statistical Society* 16 (1954): 175-185.

[6] John Fitchen, *Building Construction Before Mechanization* (Cambridge, Massachusetts: MIT Press, 1994): 80.

[7] The approximately 11-12 cm. discrepancy has been calculated for the purpose of obtaining a quick, reasonably accurate estimate, as follows: The mean plinth-to-plinth dimension, 563.883 cm., is

multiplied by the hypothetical ratio of 1:√2 (i.e., 1.414), to obtain a hypothetical column shaft height of 797.331 cm. This figure is then subtracted from the heights of the shortest and tallest column shafts in the nave, respectively, those being: Column Shaft 8, which measures 808.0 cm. high, and Column Shaft 10, which measures 809.5 cm. high (note the 1.5 cm. height difference between them).

[8] Note that the question of whether Brunelleschi inherited the the nave arcade bay proportional system from Dolfini and adapted it to his own design, or whether Brunelleschi designed it entirely, is not relevant to this discussion, which treats of the instructions Brunelleschi gave to the masons. Thus, the authorship of the proportional system is not at isssue here.

[9] On Saalman's argument that the root-5 rectangle has fifteenth century documentary justification in the *Trattato* of Filarete because, see Chapter 2, page 56 note 26.

SAN LORENZO NAVE ARCADE DUAL DIAGON TEST 1				
	Bay Number	Numerator Measurements	Denominator Measurements	Proportion Estimation
	FP2—1	1028.9	577.8	
	1—2	1029.7	565.1	
	2—3	1029.1	564.5	
	3—4	1028.6	564.5	
	4—5	1028.9	564.3	
	5—6	1029.6	564.4	
	6—7	1029.6	564.2	
	7—FP4	1029.7	563.2	
	FP7—8	1028.3	563.5	
	8—9	1028.8	564.0	Confidence Level
	9—10	1029.6	564.0	95%
	10—11	1029.8	566.2	
	11—12	1029.3	566.3	Probable Proportion Range
	12—13	1034.2	565.5	1.812 1.827
	13—14	1037.1	566.2	
	14—FP9	1031.4	575.7	
	Mean	1030.1594	566.2125	
	Standard Deviation	2.3145351	4.2357014	
	Numerators = Total Order Heights			
	Denominators = Plinth to Plinth Distances			

Figure 8.4-1 Statistical Test: San Lorenzo Nave Arcade Bays, Dual Diagon, Full Nave, 95% Confidence Level

SAN LORENZO NAVE ARCADE DUAL DIAGON TEST 2				
Bay Number	Numerator Measurements	Denominator Measurements	Proportion Estimation	
FP2—1	1028.9	577.8		
1—2	1029.7	565.1		
2—3	1029.1	564.5		
3—4	1028.6	564.5		
4—5	1028.9	564.3		
5—6	1029.6	564.4		
6—7	1029.6	564.2		
7—FP4	1029.7	563.2		
FP7—8	1028.3	563.5		
8—9	1028.8	564.0	Confidence Level	
9—10	1029.6	564.0		99%
10—11	1029.8	566.2		
11—12	1029.3	566.3	Probable Proportion Range	
12—13	1034.2	565.5	1.809	1.830
13—14	1037.1	566.2		
14—FP9	1031.4	575.7		
Mean	1030.1594	566.2125		
Standard Deviation	2.3145351	4.2357014		

Numerators = Total Order Heights, Per Bay Averages
Denominators = Plinth to Plinth Distances

Figure 8.4-2 Statistical Test: San Lorenzo Nave Arcade Bays, Dual Diagon, Full Nave
99% Confidence Level

SAN LORENZO NAVE ARCADE DUAL DIAGON TEST 3			
Bay Number	Numerator Measurements	Denominator Measurements	Proportion Estimation
FP2—1			
1—2			
2—3			
3—4			
4—5			
5—6	1029.6	564.4	
6—7	1029.6	564.2	
7—FP4	1029.7	563.2	
FP7—8	1028.3	563.5	
8—9	1028.8	564.0	Confidence Level
9—10	1029.6	564.0	95%
10—11			
11—12			Probable Proportion Range
12—13			1.824 – 1.827
13—14			
14—FP9			
Mean	1029.2583	563.8833	
Standard Deviation	0.5730765	0.4490731	

Numerators = Total Order Heights, Per bay Averages
Denominators = Plinth to Plinth Distances

Figure 8.4-3 Statistical Test: San Lorenzo, Western Six Nave Arcade Bays
95% Confidence Level

SAN LORENZO NAVE ARCADE DUAL DIAGON TEST 4				
Bay Number	Numerator Measurements	Denominator Measurements	Proportion Estimation	
FP2—1				
1—2				
2—3				
3—4				
4—5				
5—6	1029.6	564.4		
6—7	1029.6	564.2		
7—FP4	1029.7	563.2		
FP7—8	1028.3	563.5		
8—9	1028.8	564.0	Confidence Level	
9—10	1029.6	564.0		99%
10—11				
11—12			Probable Proportion Range	
12—13			1.823	1.828
13—14				
14—FP9				
Mean	1029.2583	563.8833		
Standard Deviation	0.5730765	0.4490731		

Numerators = Total Order Heights, Per Bay Averages
Denominators = Plinth to Plinth Distances

Figure 8.4-4 Statistical Test: San Lorenzo, Western Six Nave Arcade Bays, Dual Diagon 99% Confidence Level,

SAN LORENZO NAVE ARCADE PLINTH TO PLINTH DIMENSION TEST				
Bay Number	**Numerator Measurements**	**Denominator Measurements**	**Proportion Estimation**	
FP2—1				
1—2				
2—3				
3—4				
4—5				
5—6	797.9	564.4		
6—7	797.6	564.2		
7—FP4				
FP7—8				
8—9	797.7	564.0	Proportion Probability	
9—10	797.5	564.0		95%
10—11				
11—12			Probable Proportion Range	
12—13			1.413	1.414
13—14				
14—FP9				
Mean	797.675	564.150		
Standard Deviation	0.171	0.191		

Numerator = Plinth to Plinth Distance, Farther Edges
Denominator = Plinth to Plinth Distance, Nearer Edges
(Note: √2 = 1.414...)

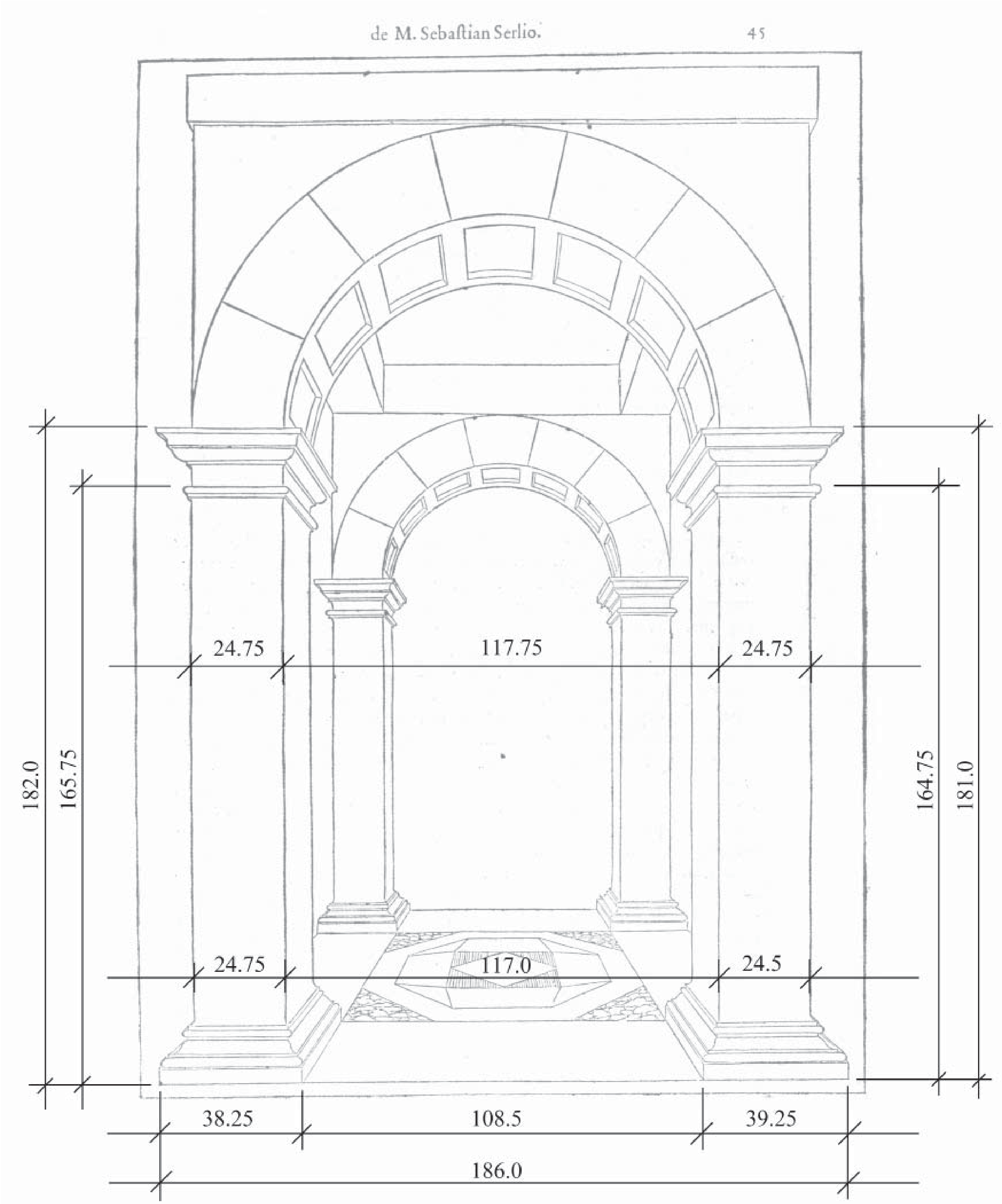
Figure 8.4-5 Statistical Test: San Lorenzo, Western Six Nave Arcade Bays, Plinth to Plinth Distances, Nearer Edges Compared to Farther Edges, 95% Confidence Level

SAN LORENZO NAVE ARCADE ROOT-2 RECTANGLE TEST			
Bay Number	**Numerator Measurements**	**Denominator Measurements**	**Proportion Estimation**
FP2—1			
1—2			
2—3			
3—4			
4—5			
5—6	809.2	564.4	
6—7	809.1	564.2	
7—FP4	808.9	563.2	
FP7—8	807.8	563.5	
8—9	808.7	564.0	Confidence Level
9—10	809.5	564.0	95%
10—11			
11—12			Probable Proportion Range
12—13			1.433 – 1.436
13—14			
14—FP9			
Mean	808.842	563.883	
Standard Deviation	0.591	0.449	

Numerator = Column Shaft Height, Average Per Bay
Denominator = Plinth to Plinth Distance (Nearer Edges)
(Note: √2 = 1.414...)

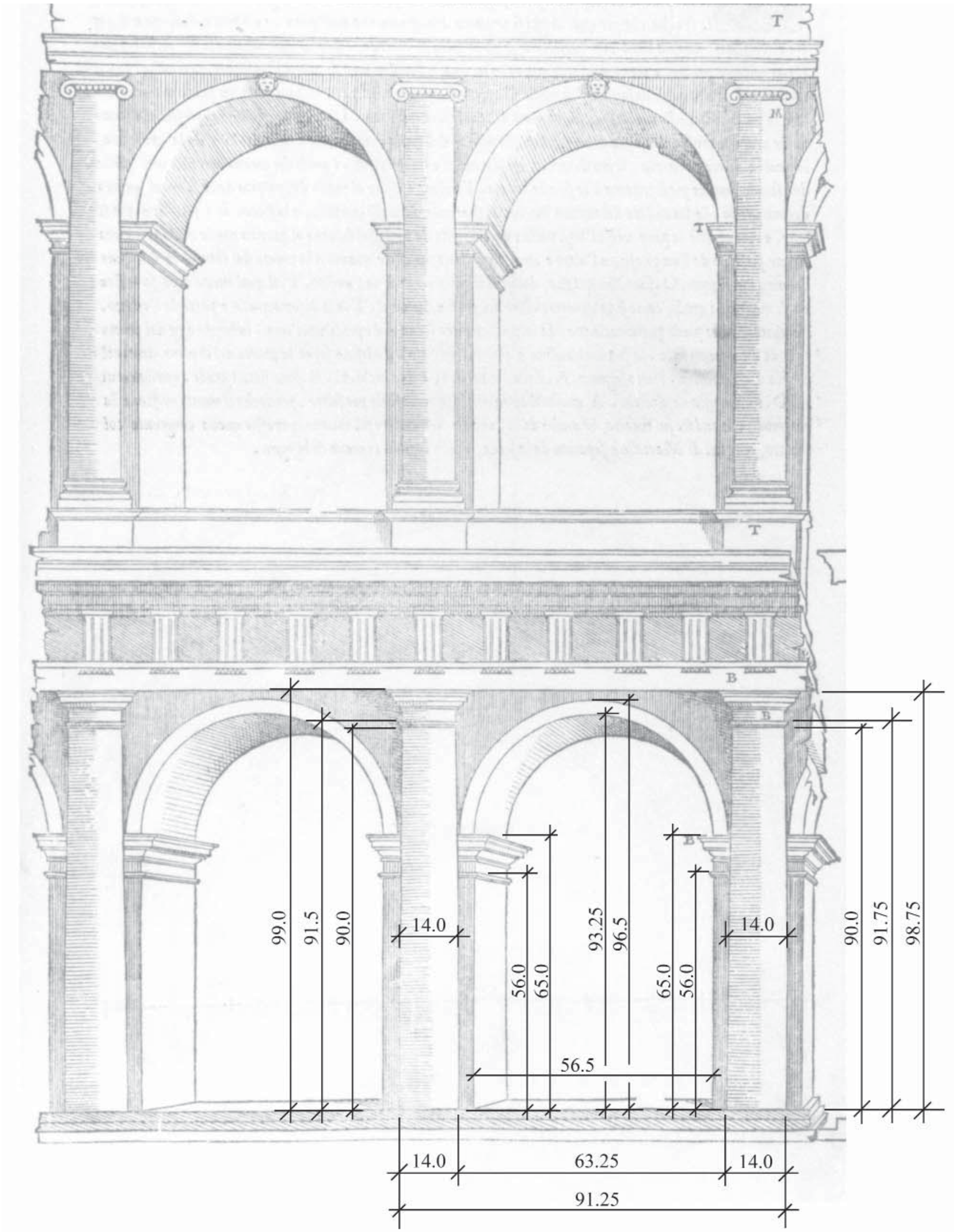
Figure 8.4-6 Statistical Test: San Lorenzo, Western Six Nave Arcade Bays, Root-2 Rectangle, 95% Confidence Level

Appendix 8.5: Serlio Drawing Measurements



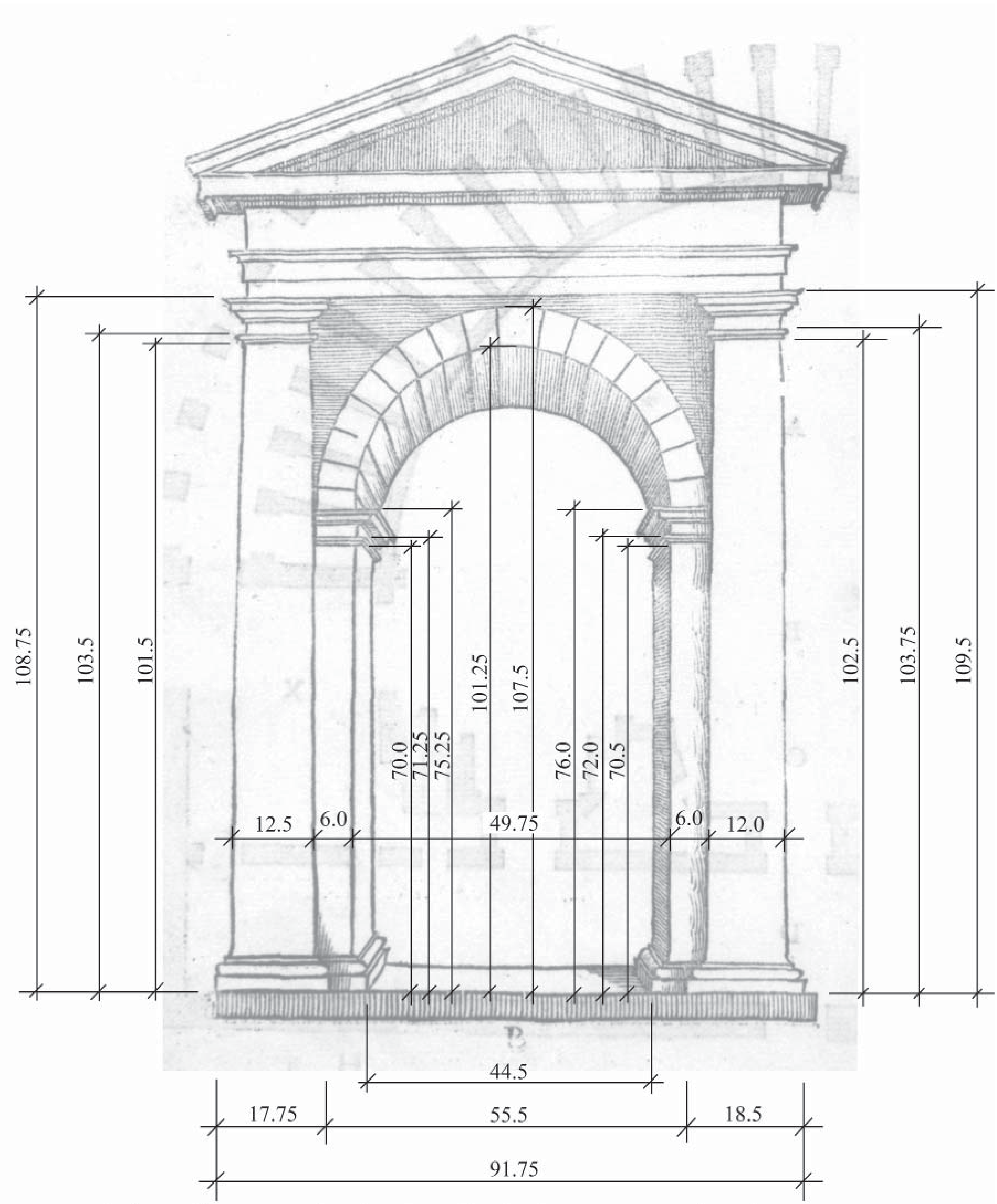
Sebastiano Serlio, Perspective Portal, *Il secondo libro d'architettura*, 1545 (Houghton Library, TYP 515.45.781 F[A]). All measurements in mm.

Figure Appendix 8.5-1



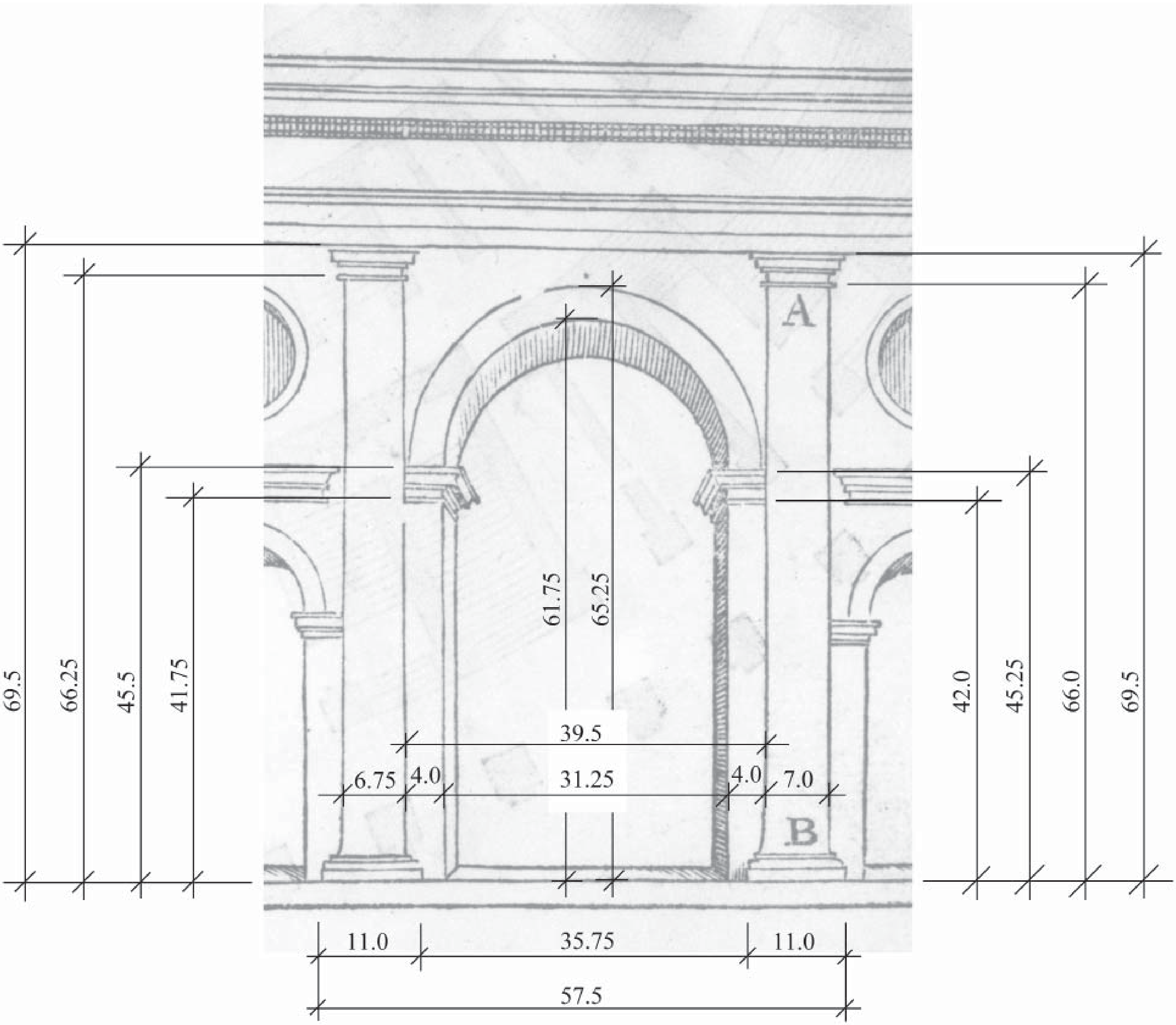
Sebastiano Serlio, Theater of Marcellus, *Il terzo libro d'architettura*, 1540 (Houghton Library, TYP 525.40.781 F). All measurements in mm.

Figure Appendix 8.5-2



Sebastiano Serlio, Roman Portal, Spoleto, *Il terzo libro d'architettura*, 1540 (Houghton Library, TYP 525.40.781 F). All measurements in mm.

Figure Appendix 8.5-3



Sebastiano Serlio, Roman City Gate, Spello, *Il terzo libro d'architettura*, 1540 (Houghton Library, TYP 525.40.781 F). All measurements in mm.

Figure Appendix 8.5-4

APPENDIX 8.6: *REGESTO* OF SAN LORENZO DOCUMENTS

SELECTED DOCUMENTARY SOURCES PERTAINING TO THE CONSTRUCTION HISTORY OF THE BASILICA OF SAN LORENZO

DOCUMENT 1374a

1374 **July 25. Provision in the testament of donna Niccoletta del fu Giovanni di Diotisalvi, wife of Nicola di Gherardo, for a contribution of 10 *libra*, toward the construction of the church of San Lorenzo.** [*ASL 1012* (July 25, 1374, Florence), from Ruschi in: *San Lorenzo 393-1993*, 1993, p. 38.]

Discussion: The small size of this contribution suggests that a widespread fund raising campaign is underway (cf. Ruschi, *ibid*.).

> *...operi et constructioni ecclesie Sancti Laurentij de Florentia in subsidium constructionis ipsius ecclesie libra decem.*

DOCUMENT 1384a

1384 **April 4. Announcement of an indulgence granted by the Bishop of Florence, Angelo Acciaiuoli II, to all those who make a contribution toward the "enlargement and improvement" (*ampliare et in melius reformare*) of the church of San Lorenzo.** [*ASL 996* (April 4, 1384, Florence), from: Ruschi, in: *San Lorenzo 393-1993*, 1993, p. 38. Also mentioned in: Cianfogni, 1804, p. 175.]

> *Cum igitur in venerabili ecclesie nostre Sancti Laurentii de Florentia per devotis in Christo filios nostros priorem et canonicos ipsius ecclesie nec non alios quosdam Christi fideles de populo ipsius ecclesie volentes cum sibi quam aliis Christi fidelibus domum hedificare terrenam, per quem adscenderent ad celestem ad ipsius venerandi nomini sancti Laurentii martyris prelibati laudem et honorem ecclesiam ipsam Sancti Laurentii ceperunt exaltare et eam tam nobili et honorabili quam utili laborerio ampliare et in melius reformare, suas operam et pecuniam cordialiter exponentes. Et nos [the bishop] cognoscentes quam ad perfectionem tanti honorabilis operis facultates et opera prefaturum non suppetant et volentes ipsos in eo quod possumus in tam laudabili proposito consonare ne tam utilis et devota ornatio et ampliatio ex defectu impotentie remaneat imperfecta ac considerantes....*

DOCUMENT 1391a

1391 **No month cited. Matteo Dolfini is elected prior of San Lorenzo, but is immediately replaced by Antonio del Bene through the intervention of the Roman Curia.** [Cianfogni, 1804, pp. 177–178, sources not cited.]

Discussion: Matteo di Bartolommeo Dolfini, a canon of the church since 1383 (see Doc. 1417a), and the future architect of the new basilica of San Lorenzo prior to Brunelleschi (Manetti, 1976, p. 106), is elected prior of the church of San Lorenzo by the other canons. The election is confirmed by the Roman Curia, only to be overturned soon thereafter by the same authority, without the knowledge of the Chapter of San Lorenzo. In Dolfini's place the Curia appoints, on December 21, 1391, Giovanni d'Amerigo del Bene–a member of a prominent Florentine family, but not a canon of the church (Cianfogni, 1804, pp. 177, 231). The previous prior, Pagno di Leonardo del Cavaliere Giovanni Strozzi, had been similarly appointed by the Roman Curia in 1378, and not chosen from among the canons of the church. Cianfogni's account follows (Cianfogni, 1804, p. 177-178):

> "L'anno 1391. seguì la morte del Priore Pagno Strozzi nel mese di Dicembre; leggendosi in un nostro ricordo, che il dì 12. detto si ricevettero due fiorini per lo drappo di Messer Pagno, cioè per la coltre presentata al suo mortorio. Il nostro Catalogo gli dà per successore Antonio di Giovanni d' Amerigo dell' illustre Fiorentina Famiglia del Bene, il quale non era del numero de' canonici. Ma due nel tempo stesso io trovo essere stati eletti al Priorato. In una lettera scritta l'anno 1391. dal celebre Coluccio Salutati, la quale si legge trall' altre sue nelle Riformagioni, in cui a nome della Repubblica, come suo Cancelliere, chiede a Roma, che sia confermata l' elezione di Matteo Dolfini in Priore di S. Lorenzo, ove egli era canonico, fatta da' suoi Colleghi, si ha sicura notizia, che questi, e non il del Bene, era stato eletto Priore dal Capitolo: oltredichè ven' è un altro non men sicuro riscontro nel libro del Camarlingo di quell' anno, ove si osserva questa partita: Per l'elezione che facemmo di Ser Matteo al Priorato fiorini due, che furono pagati al notaio. Questa elezione, la quale si faceva il giorno medesimo della morte de' Priori, non ebbe però il suo effetto; essendo state presentate, conforme può credersi, tuttochè seguita già l'elezione, Lettere Apostoliche in favore del nominato Antonio del Bene, il quale preventivamente l'avrà ottenute per l'espettativa senza saputa del Capitolo."

DOCUMENT 1404a

1404 No month cited. Matteo di Cola da Rieti succeeds Antonio del Bene as prior of San Lorenzo. [Cianfogni, 1804, p. 181, sources not cited.]

Discussion: Like his predecessors Strozzi and del Bene, da Rieti is appointed by the Roman Curia, and was not selected from among the canons of the church (see Cianfogni, *ibid*, p. 231).

> *Nell' anno 1404. si vede mancare il Priore Antonio del Bene, non si sà se per morte, o per rinunzia, e in luogo di lui esser surrogato Matteo di Cola da Rieti, e questi parimente per elezione di Roma, non essendo del numero dei canonici.*

DOCUMENT 1416a

1416 February 20 (new style). The Florentine *signoria* approves the election of six new *operai* for the church of San Lorenzo. [*ASF, Provvisioni* 98, cc. 186r–187v, from Saalman, 1993, pp. 435–437.]

Discussion: In order to help fund the enlargement of the old basilica of San Lorenzo [not necessarily—could have been simply for beautifying], the Chapter and certain citizens from the parish resolve to elect secular members of the *operai* who would have the means to buy up the houses and other properties occuping the site of the projected new church. (Cianfogni, 1804, pp. 182–183, 188; Saalman, 1993, p. 109). The following six residents of the *gonfalone del Leon d'Oro* (cf. Sodini, 1979), in addition to the prior of the church, are appointed as *operai* for a period of three years: Vieri di Andrea Rondinelli, Giovanni di Bicci de' Medici, Ugo di Andrea della Stufa, Filippo di messer Biagio de' Guasconi, Neroni di Nigio di Neroni, and Lorenzo di Andrea *beccarius*. Several of these men would later hold chapels in the new basilica. Since a purchase of land is under consideration, some general design for the reconstruction of the church must exist by this time. (Molho, apparently citing the same document, provides a different reference: *ASFi., Provvisioni-Registri*, 105, ff. 311r–312r, in Molho, 1979, p. 27, n. 51; On the custom of electing laymen as *operai*, see Elam, 1992, Appendix B, pp. 177–178.)

...Et quod ipsi cogitantes de remedio consultam Impetrare delibera uerunt facere reformarj in favorem et effectum Inferius annotandis Quare vobis jam dictis dominationis pro parte predicta deuotissime supplicatur quare vobis placeat et digneminj opportuniter prouidere et solemniter facere reformarj quod etiam absque alia fide aut probatione faciendum de vel pro aliquo superius narratorum prudentes virij

Verius andree de rondinellis — *filippus dominj blaxij de guaschonibus*
Johannes biccj de medicis — *Nerone negij neronis*
Ugo Andree dominij ugonis — *Laurentius andree beccarius*

cives florentines et de popolo sancti laurentij ac etiam priore ipsius ecclesie tam presens quam qui pro tempore fuerit non obstantes incertitudine pro summam eximio Intelligantur esse et sint electj et solemniter ac legitime deputatj in operarios et pro operarijs dicte ecclesie pro tempore et termino trium annorum proxime futuro incipiendum die qua presens petitio approbata fuerit in consilio comunis Et quod ipsi operarij incluso dicto priore et due partes ipsorum alijs etiam absentis et in requisitis aut presentibus e condicentibus vel quomodolibet impeditis habeant et habere intelligantur durante dicto tempore trium annorum plenam auctoritatem potestatem arbitrium et baliam a popolo et comuni florentie ad omnia et singula infrascripta et per omnibus et singulis infrascriptis videlicet....

DOCUMENT 1417a

1417 **August. At the death of prior Matteo di Cola da Rieti, Matteo Dolfini is elected prior of San Lorenzo for a second time.** [Cianfogni, 1804, p. 183, sources not cited.]

Discussion: This time, Dolfini's election is not overturned by the Roman Curia (see Doc. 1391a). At the time of this election, Dolfini was prior of the church of S. Martino in Quona (north of Pontasieve), and since 1402 had served, apparently concurrently, as *spedalingo* of the Ospedale di S. Matteo in Florence. Since this document notes that Dolfini had been a canon of the church for 34 years, we may deduce that he became a canon in 1383, the year prior to Bishop Acciaiuoli II's indulgence to encourage donations for the basilica reconstruction project (see Doc. 1384a). In Cianfogni's day, Dolfini's portrait was displayed, in what medium we do not know, alongside those of other past *spedalinghi*, in the cloister of the still-extant *opedale*. These portraits have since been removed, and their present whereabouts are unknown. Cianfogni's account follows:

> "Frattanto nel 1417. terminò i suoi giorni il Priore Matteo da Rieti, forse nel mese d'Agosto, in cui si legge l'ordine dato dal Capitolo di pagarsi quattro fiorini d'oro a Maestro Antonio della Scarperia celebre Medico, il quale l'avea curato nella sua ultima infermità. Dopo tre Priori eletti successivamente nella Curia Romana per l'uso, che v'era in quei tempi, delle Grazie di Espettativa, potè questa volta il Capitolo fare a suo piacimento l'elezione del nuovo; la quale cadde per la seconda volta nella persona di Matteo di Bartolommeo Dolfini, da trentaquattro anni canonico [i.e., since 1383], e insieme Priore di S. Martino a Quona.... Che egli fosse considerato per un'uomo di merito, e atto al governo, si può dedurre dall' averlo eletto i suoi Colleghi un' altra volta Priore, ma senza effetto nel 1391, e dall' essere stato creato l'anno 1402 Spedalingo del già Spedale di S. Matteo di questa nostra Città, ove nel chiostro sene vede ancora il ritratto frà gli altri Spedalinghi."

DOCUMENT 1417b

1417 **September 28. Petition by the prior and canons of San Lorenzo to the Florentine *signoria* requesting comunal jurisdiction over the church.** [Cianfogni, 1804, pp. 226–

228, sources not cited; for partial English translation, see Battisti, 1981, pp. 366–377.]

Discussion: The petition seeks to end the ancient link to the Roman Curia by noting that the appointments of priors by the Curia "...have ruined the...church beyond and against the will of the...Supreme Pontiff" (*...quandocumque accidit electionem de persona fieri, cuius dicta Ecclesia ponitur in ruina, preter, & contra dicti Summi Pontificis voluntatem*). At the time of this petition, Ugo di Andrea della Stufa, a leading parishioner in the *gonfalone del Leon d'Oro* and an *operaio* of the church (Doc. 1416a), was sitting as *Gonfaloniere della Giustizia* (Saalman, 1993, p. 109)–a well-placed ally who perhaps expedited approval of the petition.

In Dei nomine Amen. Anno Incarn. Dom. N.I.C.MCCCCXVII. Ind. X. die XXVIII. Mensis Septembris. In Consilio Populi Civitatis Florentie, & die ultimo in Consilio Communis Civitatis predicte mandato Magnific. DD. Priorum Artium. & Vexilliferi Iustitie Populi & Communis Florentie precona convocatione, campaneque souitu in Palatio Populi Flor. more solito congregatorum. Quorum DD. Priorum & Vexilliferi nomina sunt ista, videlicet, Andreas Francisci Banchi, Banchus Nicolai Bencivennis vaiarius, Dominicus Nicolai Michelozzi Magaldi, Ioannes Francisci Bisfoni, D. Carolus Francisci Federici, Pierus Ioannis Anselmi, Franciscus Ioannis Calandri, Philippus Neri del Cavallina, & Ugo Andree D. Ugonis de Stufa Vexillifer Iustitie. Ego Martinus Luce Martini d Florentia Notarius, & Scriba Reformationum Consiliorum Populi, & Communis Florentie legi, & recitavi inter dictos Consiliarios in sufficienti numero congregatos infrascriptas Provisiones. Et primo Provisionem infrascriptam &c. Quarto Provisionem, infrascriptam super infrascripta petitione, & omnibus, & singulis in ea contentis deliberat: & fact: per DD. Priores, & Vexilliferum, & Gonfalonrios Societatum Populi, & XII. Bonos Viros Communis Florentie secundum Ordinamenta dicti Communis. Cuius quidem petitionis tenor talis est: videlicet. Exponitur cum omni reverentia debita vobis Magnificis, & Potentibus DD. Prioribus Artium, & Vexillifero Iustitie Populi, & Comunis Florentie pro parte D. Mattei Prioris Ecclesie S. Laurentii de Florentia, ac etiam canonicorum dicte Ecclesie, quod electio Prioris dicte Ecclesie secundum Ius canonicum pertinet ad canonicos predictos cum confirmatione D. Episcopi Florentini, quamquam principaliter etiam fieri possit per D. Summum Pontificem, quotiescumque de beneplacito sue Sanctitatis procedit, & quod a certo tempore circa huiusmodi electio facta sit in Curia Romana: & quia Summus Pontifex non potest semper cunctorum veritatis habere notitiam, quandocumque accidit electionem de persona fieri, cuius causa dicta Ecclesia ponitur in ruina, preter, & contra dicti Summi Pontificis voluntatem. Et quod ipsi putantes salubrius esse pro dicta Ecclesia, que ex antiquioribus vestre Civitatis habetur, protectionem vestre Dominationis habere precipue cum impetrare volentes magis moderate procedent in procuratione, & etiam in electionis huiusmodi, &etiam in multis aliis tenent dictam Ecclesiam, & eius bona debere cotidie ob id recipere incrementa, atque favores, non intelligentes propterea aliquid postulare, quod contra Romauam Ecclesiam, seu Sacras eius Constitutiones possit directe, vel per obliquum aliqualiter redundare aligentes viam, quam pro multis beneficiis, atque locis Ecclesiasticis Prelati Gubernatores eorum, nam multi tempore elapso prosecuti fuere, deliberaverunt supplicare, prout inferius apparebit. Quare vobis DD. antedictis pro parte predictoram devotissime postulatur, quatenus eisdem placeat, & dignemini opportune providere, ac solemniter, facere reformari, quod dicta Ecclesia S. Laurtentii de Florentia cum eis edificiis, atque bonis, & iuribus quibuscumque extunc intelligatur esse, & sit sub Protectione, tutela, atque defensa Populi, & Communis Florentie, ac Officialium Magnific. & Pontent. DD. Priorum Artium, & Vexilliferi Iustitie Populi, & Communis Florentie, tam presentium, quam pro tempore existentium. Et quod ipsi DD. Priores, & Vexillifer Iustitie teneantur, & debeant quandocumque quotiescumque exinde requisiti fuerint pro parte Prioris dicte Ecclesie, & canonicorum eius, seu alicuius, vel aliquorum ex eis pro defensione, manutentione, atque exaltatione dicte Ecclesie, seu augmentatione ipsius, & eius quorumcumque bonorum, & iurium, quoscumque impendere favores, atque suffragia, & intercessiones quascumque facere, & omnia sollecite operari, que ad utilitatem, commodum, exaltationem, augmentationem, atque conservationem dicte

Ecclesie, & bonorum, & iurium predictorum redundare crediderint nihil ad hec utilia omittendo eo in predietis omnibus, & singulis salvo, & excepto quod predicta, vel aliquorum eorumdem non intelligantur esse, vel sint inra Populi S. Laurentii predicti, seu alicuius, vel aliquorum Patronorum, seu si qui sunt, seu alicuius alterius Secularis persone irrita, seu in aliquo vitiata, vel immutata, seu variata, sed in eo esse, in quo ad presens sunt intelligatur esse, & sint unicuique reservata remanere, & sic debeat effectualiter observari. Super qua quidem petitione, & omnibus, & singulis in ea contentis dicti DD. Priores, & Vexillifer Iustitie habita super predictis, & infrascriptis omnibus, & singulis invicem, & una cum Offitialibus Gonfalonriorum Societatis Populi, & XII Bonorum Virorum Communis Florentie deliberatione solemni, & secreto scrutinio ad fabas nigras, & albas, & obtento partito secundum formam Statutorum, & Ordinamentorum dicti Communis, eorum proprio motu pro utilitate Communis eiusdem, & omni modo, via, & iure, quibus melius potuerunt, providerunt, ordinaverunt, &deliberaverunt die XXVIII Mensis Septembris anno Domini MCCCCXVII. Ind. XI., quod dicta petitio, & omnia, & singula in ea contenta procedant, firmentur, & fiant, & firma, & stabilita esse intelligantur, & sint. & observentur, & observari, & executioni mandari possint, & debeant in omnibus, & per omnia secundum petitionis eiusdem continentiam, & tenorem. Non obstantibus in predictis, vel aliquo predictorum aliquibus legibus, statutis, ordinamentis, provisionibus, ant reformationibus Consiliorum Populi, & Communis Florentie obstaculis, seu repugnantiis quibuscumque, etiam quantumcumque derogatoriis penalibus, vel precisis, vel etiam si de eis, vel ipsorum aliquo debuisset, vel deberet fieri specialis mentio, & expressa. Quibus omnibus, & singulis intelligantur esse, & sit nominatim, & expresse specialiter, ac generaliter derogatum.

Ego Bartholomeus Bambi Ciai unus ex Notariis Actorum Camere Communis Florentie suprascriptam reformationem sumpsi ex libro Ser Martini Luce Martini olim Notarii Reformationum Populi, & Communis Florentie in Camera Actorum predictorum existenti ad fidem predictorum me subscripsi die XII. Mensis Maii anno Dom. MCCCCLII. Ind. XIV., & ideo meum consuetum Signum apposui.

DOCUMENT 1417c

1417 **November 17. Fourteen new articles are added to the church constitution, upon the recommendation of Dolfini.** [Cianfogni, 1804, pp. 186–188, sources not cited. See also Cianfogni, 1804, p. 183]

Discussion: Approved by the Bishop of Florence, Amerigo Corsini, on November 17, 1418, Among other reforms, Dolfini's fourteen articles contain measures to curb perceived excesses such as distributions of money, chickens, wine, and other goods several times a year to the prior and thirty of the resident canons, and to encourage the canons to pursue studies of the sciences (*le scienze*). Previous to Dolfini’s fourteen new articles, the last modifications to the church constitution had been the addition, in 1375, of seventeen new articles, undertaken by the last prior to be elected by the canons of San Lorenzo, rather than appointed by the Roman Curia, Ricco di Gianni (see Cianfogni, 1804, pp. 171, 231). Cianfogni’s account follows:

> “Dell' aver fatta il Capitolo un' ottima elezione del Priore nella persona di Matteo Dolfini, ne diede una riprova la premura, che questi ebbe di provvedere al maggior culto di Dio, al miglior servizio della Chiesa, e di togliere gli abusi, e disordini, che vi s'erano introdotti, col procurare l'anno 1418. di consenso, e volontà dei Conaonici, che fosse fatta un' aggiunta di altri quattordici Capitoli alle antiche Costituzioni. Questi furono presentati al Vescovo Fiorentino Amerigo Corsini, il quale maturamente consideratigli, e trovatigli vantagiosi, e necessari per la pace, e l'unione dalla Comunità, e pel buon governo sì spirituale, che temporale della Chiesa, gli approvò, e con un suo decreto diede loro tutto il vigore per un' esatta osservanza il dì 17. di Novembre dell' anno suddetto. Le cose, che mi sembrano da osservarsi in questi nuovi Capitoli, sono:
>
> Che in S. Lorenzo, oltre la Quaresima, e l'Avvento, si predicava la mattina del Santo,

di. S. Concordia, e di S. Marco Evangelista nella Chiesa di S. Marco Vecchio; dove interveniva per antica consuetudine a uffiziare il Capitolo; la Vigilia della commemorazione dei Defunti, e tutte le Domeniche dell' anno; e le Prediche della mattina si facevano inter Missarum Solemnia.

Che dopo la Compieta della Vigilia di S. Lorenzo si cantava ad concursum Populi un Notturno del Mattutino della Festa, cioè, l'Invitatorio, l'Inno, l'Antifone, e i Salmi del primo Notturno, colle Lezioni, e i Responsori del secondo, il Te Deum, e l'Orazione; e questo si chiamava l'Ufizio della Vigilia, e la mattina a buon' ora si cantava pure ad concursum Populi una Messa prima della solenne; il che si usa anche al presente.

Qualora al Priore, e ai canonici fosse piaciuto di desinare insieme nel comune refettorio nelle Feste di S. Lorenzo, di S. Marco Evangelista, e di S. Concordia, dovevano rilasciare le distribuzioni di quei giorni: in fatti si vedono notati in alcuni anni di questi pranzi.

Il grano che si doveva annualmente a titolo di distribuzioni del Coro, nella quantità di sessanta staia al Priore, e di trenta ai canonici residenti, e costituiti in Sacris, tutti i danari, i polli, il vino, e altre cose, che si davano loro oltre le ordinarie distribuzioni, nelle Feste di S. Lorenzo, di S. Marco, e di S. Concordia, i taglieri, e le scodelle per la Resurrezione, e per l'Ognissanti, e in quest' ultimo giorno le Oche, fù stabilito, che queste cose non si dessero più, ma di tutto si facesse un cumulo di danaro, e sene assegnasse una parte in accrescimento delle quotidiane distribuzioni al Priore, e ai canonici; una parte in una maggiore distribuzione nelle Feste Solenni, in cui per lo maggior concorso del popolo v' era bisogno di un maggior numero di chi uffiziasse la Chiesa, e un'altra parte in una minore distribuzione nei giorni di Rito minore, i quali vi si descrivono.

Una distribuzione più copiosa fù destinata al Priore, e ai canonici per la Festa di S. Lorenzo, a tutti i Cori della quale v' era l' ius accrescendi per gl'interessenti, se mai alcuno di loro avesse mancato d' intervenirvi; con questa dichiarazione, che intervenendovi i canonici, che non erano in Sacris, anch' essi come gli altri ne fossero capaci; e che i non residenti si ammettessero alla particolare distribuzione, che si dava quella mattina a chi celebrava in Chiesa la Messa, qualora vel' avessero celebrata; tuttochè nel rimanente dell' anno non avessero diritto alle quotidiane ditribuzioni, nè agli utili della Chiesa.

Considerando il Capitolo, che non solamente la Chiesa universale, ma anche le particolari hanno bisogno d' uomini scienziati; affinchè la Chiesa di S. Lorenzo potesse avere canonici forniti di scienze, e che niuno di essi si rimovesse dallo studio per la diminuzione delle distribuzioni, fù stabilito, che quelli, che volevano attendere ai Sacri canoni, o alla Teologia, ne' giorni della scuola non potendo intervenire la mattina alla Messa cantata, quando intervenissero il giorno al Vespro, conseguissero la distribuzione. E quì piaque al Capitolo di usare una distinzione al canonico Baldassarre di Scarperia [footnote omitted], il quale conviene credere, che e fosse dotato di particolari talenti, applicato in quel tempo allo studio de' Sacri canoni; perocchè fù abilitato non solo a poter conseguire la quotidiane distribuzioni, siccome gli altri, in tutti quei tempi che egli fosse andato all scuola, purchè fosse intervenuto al Mattutino, e ne' giorni liberi da quella, alla Messa Conventuale; ma eziandio le particolari, che si davano a chi celebrava in Chiesa in certi determinati giorni, benchè egli non fosse ancor Sacerdote: e questo privilegio gli fù conceduto per dieci anni."

DOCUMENT 1418a

1418 **December 22. Petition by the prior and canons of the church of San Lorenzo to the Florentine *signoria* requesting that public land be ceded for enlargement of the church building.** [*Archivio di Stato di Firenze, Reg. di Provv. dei Consigli Maggiori, reg. 108, c. 193 e sgg*., from: Ginori Conti, 1940, pp. 234–236; for partial English translation, see Battisti, 1981, pp. 367.]

Discussion: With this petition Dolfini formally initiates the physical reconstruction of the church, a task for which he was to serve as *capomaestro* (Manetti, 1976, p. 106). Dolfini requests a plot of land located behind the old basilica of San Lorenzo, to include private property, a portion of a public street, the *Via dei Preti*, and a small piazza. Clearing this land could only be in the best interest of the *comune*, the petition argues, because it is occupied by "persons of the lowest class and uncommendable repute...for the most part foreigners" (*…gens conditionis depresse, fame non commendabilis...& ut plurimum aliene Nationis*...). The requested land is to measure 65 br. in length, measured from the back wall of the old church, by 110 br. in width (*ex posteriori parte extendi per longitudinem debet brachiis sexaginta quinque, et per latitudinem centumdecem*), the latter intended to accomodate chapels, a sacristy, and other unspecified parts of the church (*Et quia ecclesie huiusmodi corpus cum cappellis, sacrestia, et aliis opportunis*…). Considering the specificity of these dimensions, by this time Dolfini must have completed a detailed design for a new basilica of San Lorenzo.

> *In Dei nomine Amen. Anno Inc. Dom. Nostri Ihesu Christi MCCCCXVIII, Ind. XII, die XXII mensis Decembris. In Consilio Populi, et die vigesimo tertio mensis eiusdem, in Consilio Communis, mandato Magnific. DD. Priorum Artium Vexilliferi Iustitie Populi, et Communis Florentie offitio presidentium, precona invocatione, campaneque sonitu, more solito, congregatis. Quorum dd. Priorum, et Vexilliferi nomina ista, videlicet: Bertus Miliani Salvini, Franciscus Zuccherini de Uzzano, Bertus Zenobii Berti Rainerii, Duccius Taddei Mancini, Iacobus Montis Pugii ferravecchius, Michael Fei Dini galicarius, Iacobus Francisci Iannis campsor, Sennus Nicolai Arrigi, priores Artium, et Franciscus Francisci Pierozzi della Luna Vexillifer Iustitie. Et per ipsa Consilia, in numero sufficienti congregata, in palatio Populi Florentini totaliter approbata, admissa, et accettata fuit infrascripta provisio facta, et edita super infrascripta petitione, et omnibus, et singulis in ea contentis per ipsos dominos Vellixiferum, Priores, Gonfalonrios Societatum Populi, et XII. Bonos Viros Communis predicti, secundum ordinem Communis predicti, et infra proxime annotata, et scripta; et provisum, et ordinatum fuit, quod in iis, et super iis omnibus, et singulis infrascriptis procedatur, observetur, firmetur, et fiat, et firmum, et stabilitum esse intelligatur, et sit in omnibus, et per omnia secundum, et prout inferius continebitur, cuius quidem, et super ea edite Provisionis tenor talis est, videlicet. Exponitur cum omni debita reverentia vobis, magnificis, et potentibus dd. Prioribus Artium, Vexillifero Iustitie Populi, et Communis Florentie pro parte Prioris, canonicorum, et Capituli S. Laurentii de Florentia, quod ipsi ad honorem Dei, decoremque vestre civitatis putaverunt dictam S. Laurentii Ecclesiam, civium auxilio, ampliare, et pulcherrimis edificiis reformare, et iam constructionis opus designarunt. Et quia ecclesie huiusmodi corpus cum cappellis, sacrestia, et aliis opportunis ex posteriori parte extendi per longitudinem debet brachiis sexaginta quinque, et per latitudinem centumdecem in ordine Cappellarum, et infra spatia antedicta pars cuiusdem vie, que dicitur la via de Preti, in qua, multis respectibus, continue habitare dignoscitur gens conditionis depresse, fame non commendabilis, nec vite, et ut plurimum, aliene nationis, et quedam plateuncula fipsius Ecclesie, et alia ad Commune Florentie pertinentia includuntur; et etiam, quia sunt alique parve domus ad privatos spectantes, qui, si repugnantes essent concepto operi multum nocere possent cunctorum bonorum residuo ad ipsum Capitulum pleno iure pertinenti: et quod ipsi hoc tam sanctum opus Deo, atque mundo, vestreque Dominationi honorabile, atque devotum, ad perfectionem non posse deducere dubitantes quin ymmo, ut designatum est, sine vestre Dominationis suffragio non valeant, deliberaverunt ad pedes vestre Magitudinis recursum habere, et infrascriptum beneficium devotissime postulare sperantes clementiam vestre Dominationis eisdem esse minime defuturam, tum quia omnes Ecclesias, quas amplitudo vestre jurisdictionis ambit, semper fuistis beneficiis prosecuti, tum quia ecclesia hec, singulari Consiliorum vestrorum beneficio, sub vestra protectione quiescit; quare vobis prefatis Dominis, pro parte predicta humiliter supplicatur, quatenus vobis eisdem placeat, et dignemini opportune povidere, et solemniter facere reformari, quod etiam absque aliqua fide, aut probatione de, vel pro aliquo superius narratorum facienda, vel alia solemnitate servanda, omnia, et quecumque bona immobilia existentia infra spatia supradicta, etiam ad quemcumque pertinerent, seu cuiuscumque forent, et tam Comunis Florentie, quam cuiuscumque alterius Comunis, collegii, societatis, vel universitatis, aut*

singularis persone etiam cuiuscumque status, conditionis, et qualitatis existentis ex nuc, deinceps in perpetuum intelligantur pertinere, et expectare, et pertineant, atque expectent ad Capitulum antedictum, libera pleno iure proprietatis, et possessionis ipsius Capituli sint, et esse intelligantur, et de ipsis bonis possit libere facere velle suum tanquam verus dominus, et possessor eorumdem, omni oppositione, et repugnantia, atque contradictione cessantibus. Eo intellecto quod ipsum Capitulum teneatur, et debeat de valuta ipsorum bonorum ad alium, quam ad Commune Florentie pertinentium satisfacere domino, seu dominis eorumdem, secundum declarationem valoris, quandocumque faciendam per Offitiales Turris Communis Florentie, aut duas partes ipsorum, aliis etiam absentibus, et irrequisitis, aut presentibus, aut contradicentibus, vel quomodolibet impeditis, et huiusmodi declarationi quelibet partium stare debeat, et per quemlibet observari omni exceptione remota. Hoc etiam ad omne dubium removendum apposito, quod pro bonis ad Commune Florentie pertinentibus nulla satisfatio fieri debeat eidem Communi, sed ex dono, et liberalitate Communis Florentie, et amore Dei, et S. Laurentii, et ad hoc, ut dicta edificatio fiat in Dei honorem, atque Sanctorum eius, et Civitatis decorem. Et pro ipsis non possit aliquis in perpetuum ad aliquid dandum, vel solvendum eidem gravari, inquietari, vel molestari in persona, vel bonis quoquo modo. Super qua quidem petitione, et omnibus, et singulis in ea contentis dicti dd. Priores, et Vexillifer, habita super predictis, et infrascriptis omnibus, et singulis invicem, et una cum offitio Gonfalonriorum Societatum Populi, et XII Bonorum Virorum d. Communis deliberatione solemni, et demum inter ipsos omnes in numero sufficienti congregatos in palatio Populi Flor., premisso, et facto solemni, et secreto scrutinio ad fabas nigras et albas, et obtento partito secundum formam statutorum, et ordinamentorum dicti Communis, eorum proprio motu, pro utilitate Communis eiusdem, et omni modo, via, jure, et forma, quibus magis, et melius potuerunt, providerunt, ordinaverunt, et deliberaverunt, die vigesimo Mensis Decembris anno MCCCCXVIII, Ind. XII., quod dicta petitio, et omnia, et singula in ea contenta procedant firmiter, et fiant, et firma, et stabilita esse intelligantur, et sint, et observentur, et observari, et executioni mandari possint, et debeant in omnibus, et per omnia secundum petitionis eiusdem continentiam, et tenorem. Non obstantibus etc.

INTERPOLATED DOCUMENT 1419a

(1419) **No month cited. Two references to commencement of construction of the high altar chapel in 1419, excerpted from later documentary sources.**

Discussion: According to a deliberation of the *gonfalone del Leon d'Oro* of November 20, 1440, the foundations of the high altar chapel were begun by prior Dolfini "in the year 1419, or thereabouts" (*quod de anno 1419, vel circa*) as part of an enlargement of the church building (Doc. 1440c). Perhaps based on the same document of 1440, a deliberation of the chapter of San Lorenzo of August 13, 1442 notes that it had been, at that time, "twenty-three years, or thereabouts" (*viginti tres anni vel circa*) since the new church of San Lorenzo was begun "from the upper end and high altar chapel" (*ex latere superiori, et maiorem capellam*; Doc. 1442e). Other evidence, however, suggests that construction started a few years later (see Docs. 1421a, 1421b, 1422e, 1422f, and 1422g). It is possible that the authors of the 1440 document based their estimate not on knowledge of actual events, but on the petition of December 1418 (Doc. 1418a) adding a few months to it for assumed start-up time. The authors of the 1442 document could have followed suit.

Cum hoc sit, ut infrascriptus dominus prior asseruit, quod de anno 1419, vel circa, tempore recolende memorie domini Mattei Dolfini, tunc prioris ecclesie, et celeberrimi templi S. Laurentii predicti, et infrascripti domini Benedicti nunc prioris, et tunc canonici dicte ecclesie et templi fuisset incepta fundari cappella major ecclesie, et templi predicti pro ampliando dictam Ecclesiam.... (see Doc. 1440c).

Attendentes quod iam sint viginti tres anni vel circa prefati prior, canonici, et Capitulum...contruere inceperunt, et edificare novam ecclesiam S Laurentii ex latere superiori, et maiorem capellam.... (see Doc. 1442e).

DOCUMENT 1420a

1420 **Reference to a fornaio "in sul chanto della via della stufa dirimetto alla porta della chiesa."** [ACSL 2408, 2r; from Caroline Elam's notes transmitted to Matthew A. Cohen via e-mail, 28 April 2010.]

Discussion: inserted directly from Elam e-mail; needs to be edited.

DOCUMENT 1421a

1421 **August 10. Desciption of a ground breaking ceremony for construction of the new church building.** [Biblioteca Medicea Laurenziana, Florence, ASL, 2422, Entrata e Uscita del Capitolo di San Lorenzo, 1421–1422, c. 44v, from *Donatello e la Sagrestia Vecchia,* 1986, p. 102; also quoted in Ruschi, 1989, p. 85 n. 4.]

Discussion (a): On the feast day of San Lorenzo, the reconstruction of the church is ritually commenced with an evening ground breaking ceremony. The church prior (either Bartolomeo da Vinci or Benedetto di Matteo Schiattesi; see Doc. 1422d), canons, *operai*, and other dignitaries walk in procession, with olive branches in hand, from the home of one of the canons of the church, "ser Neri," (Cianfogni, 1804, p. 191), where they had partaken of a meal of *cialdoni* (pastry horns), peaches, fennel and nuts, to a site behind the old campanile. There, each gives a single blow with a mattock. This document suggests that construction did not in fact begin in 1419 (see Doc. 1419a). On the other hand, it could mark a formal recommencement of the project according to Brunelleschi's new design (see Doc. 1420a).

[...] *A dì 10 d-agosto p[er] pesche e finocchio e noci preparate per la seconda colatione chessi fece i*[n] *casa di ser Neri e fuvvi il vicario e gl-operai e i maestri che s-andò detta sera e detto il vespro a processione in sulla sera, et ognuno e priore e canonjcj con l-ulivo in mano e posoro*[n]*si dietro il ca*[m]*panile et ognuno diede una marrata dove si debbon fare i fondamenti per libbre dieci* [...] *di cialdoni* [...]."

Discussion (b): This document has been published several times, each time slightly differently. The most recent version reads as follows (Pacciani, 1994, p. 94, Doc. 1):

Adì detto [10 agosto] *per pesche e finochio e noci schiaciate per-lla sechonda chollazione che-ssi fece in chasa ser Neri e fuvi el vichario e gl'operai e maestri, che s'andò detta sera e detto il vepro a processione cholla croce ed ognuno e priore e chanonici choll'ulivo in mano e posoronsi detro el champanire ed ognuno de' una maratta dove si debbon fare e fondamenti, e chostorono le dette frutte soldi dicenove: f.-, s. XVIIII*

DOCUMENT 1421b

1421 **August 18. Masons store their tools in a nearby house during excavation of the foundations of the church.** [ACSL 2422, c. 46r, August 18, 1421, from Pacciani, 1994, p. 94, Doc. 2.]

Discussion: As the first known contemporaneous record of construction activity, this document further suggests that the actual start of construction took place in 1421 rather than 1419 (See Doc. 1421a and discussion). Saalman, 1993, p. 112, n. 19, provides a more abbreviated transcription.

> *Adì detto* [18 agosto] *a uno chiavaiuolo, per uno chiavistello e per una chiave e una toppa feci porre alla chasa asegnamo a Bartelo Maringhi dove tenessono loro chose quando chavono i fondamenti. Costò soldi quatordici ogni chosa: f. – s.XIIII*

DOCUMENT 1422a

1422 **February 28 (new style). The Nelli family is assigned the chapel north of the high altar chapel, between the della Stufa and Ginori chapels.** [*ASF, Notarile antecos. C.525, Ser Angelo di Cinozzo di Giovanni Cini 1437-1455, fol. 272r*, from: Elam, 1979, Doc. A, p. 184.]

> **Discussion (a):** Since this document mentions the neighboring della Stufa and Ginori chapels, it serves as a *terminus ante quem* for the assignment of those chapels.
>
> **Discussion (b):** The reference in this document to prior Matteo Dolfini as *absente* may indicate that he had recently died and that his position, noted in the document perhaps in order to confer legitimacy upon the transaction, had not yet been filled. Just over one month later, a new prior, Bartolomeo da Vinci, appears in the documents (Doc. 1422d).
>
> *...Certum esse dicitur quod de anno domini...millesimo quadragesimo vigesimo primo et die ultimo mensis februarii dicti anni vel alio veriori tempore quidam operarii ecclesie S. Laurentii de florentia absente M. domino Matteo Dolfini tunc priore dicte ecclesie...dederunt et concesserunt Antonio S. Bartolomei S. Nelli Ghetti civi et mercatori florentino populi S. Laurentii predicti locum et solum ipsius loci usum pro hedificando unam cappellam iusta cappellam hedificandam per laurentium et lotteringhum Andree domini Ughonis della Stufa et Iohannes laurentii de dicta stufa versus viam burgi Nocis Et contiguum cappelle hedificande per heredes Zenobii S. Ginii dicti populi....*

DOCUMENT 1422b

1422 **March 7 (new style). Testament of Albizo di Toso da Fortuna stating his intention to be buried in the church of San Lorenzo.** [*ASF, Magistrato dei Pupilli avanti il Principato*, 41, c. 136v, from: Pacciani, 1994, p. 95, Doc. 16.]

Discussion: This document provides a possible, but as yet unverified *terminus ad quem* for assignment of the transept chapel adjacent to the north wall of the Old Sacristy to Albizo. By July 21, 1423 the chapel had undoubtedly been assigned to him (Doc. 1423d).

[…] *prudentis et discretus vir Albizus quondam Tosi civis et mercator florentinus et de populo Sancti Laurentii de Florentia* […] *sui corporis sepulturam* […] *elegit et etiam voluit et deputavit in ecclesia Sancti Laurentii de Florentia in tumulo et sepulcro dicti testatoris* […]

DOCUMENT 1422c

1422 **April 21. Legislation extending the one-year term of the *operai* of the church of San Lorenzo by another year.** [*ASF Provvisioni Registri 112*, fos. 12v-13v, 21 April 1422, from: Elam, 1992, p. 167, n. 43].

Discussion: According to Elam (1992, pp. 166-167), this document shows that the three original patrons of the *Cappella degli Operai*, Niccolò di Ugolino Martelli, Aldobrandino di Giorgio Aldobrandini, and Taddeo di Filippo Taddei, served as *operai* on the lay building committee at the same time during the period extending one year before and one year after the date of the document. It thus establishes a two year range within which the chapel is likely to have been jointly allocated to these three *operai*, from April 1421 to April 1423. The earliest known reference to this chapel as the Cappella degli Operai dates to 1427 (Doc. 1427c). The earliest reference to all three original patrons of this chapel dates to 1463 (Doc. 1463a).

> […] *prudentis et discretus vir Albizus quondam Tosi civis et mercator florentinus et de populo Sancti Laurentii de Florentia* […] *sui corporis sepulturam* […] *elegit et etiam voluit et deputavit in ecclesia Sancti Laurentii de Florentia in tumulo et sepulcro dicti testatoris* […]

DOCUMENT 1422d

1422 **April 3. Record of Archbishop's visit to San Lorenzo in 1422 noting that the prior at the time was Bartolomeo da Vinci.** [*Archivio Arcivescovile*, Florence, *Libro di visite dell'Arcivescovado nel 1422*, fo. 13r, from Elam, 1992, p. 161, n. 17 and 18.]

Discussion: Based on this document, Dolfini's successor as prior of San Lorenzo appears to have been Bartolomeo da Vinci, and not Benedetto di Matteo Schiattesi, as stated by Cianfogni (Cianfogni, 1804, p. 190, incorrectly cited in Elam, 1992, p. 161, n. 18 as: Moreni, *Continuazione*, i, 4). Cianfogni, in his brief biography of a church canon named Bartolomeo di Andrea Bertini da Vinci, asserts that Bertini never served as prior of the church (Cianfogni, 1804, p. 234), as maintained, he claims, by Salvini in his *Istoria dei canonici del Duomo*. Evidently Cianfogni, Salvini, or both must have confused the two Bartolomeos. Cianfogni appears to have been unaware of the document quoted here, and of any other evidence of the priorship of Bartolomeo da Vinci. By November 12, 1422, Benedetto di Matteo Schiattesi is named in another document as the sitting prior (see: Elam, *ibid*., and Moreni, II, 1817, p. 355ff.).

> *...cui ecclesie est prior Dominus Bartolomeus de Vincio quem ibi non reperiit quia est residens in Curia romana.*

DOCUMENT 1422e

1422 **September 23. Houses located along *via de' preti* are demolished to make way for the transept and transept chapels.** [*ASL 2311, Libro di entrata e uscita del Capitolo e ricordi del Capitolo di San Lorenzo*, 1422, c. 13r and v, from Pacciani, 1994, p. 95, Docs. 6 and 7.]

Discussion: The following excerpts are representative of the many similar documents, dated September—October 1422, that Pacciani transcribes (Pacciani, 1994, pp. 94-95, Docs. 3-13, brackets are Pacciani's). The demolitions they describe are direct consequences of Dolfini's petition of 1418 (Doc. 1418a).

> C. 13r
> *Angelino d'Iachopo della Magnia tiene a-ppigione un terreno della prima chasa della via de' preti, pagha l'anno di pigione lire sei. Chommincia l'anno dì primo di luglio 1422, l. VI* [segue la somma dei pagamenti fino al 15 di ottobre per un totale di l. 1 s. 15]
> *Adi 23 di settembre 1422 si disfecie per fare la chiesa nuova cioè le chappelle.*
>
> C. 13v
> Martino da Genova *tiene a-ppigione il palcho della prima chasa della via de' preti, pagha l'anno di pigione lire sei. Chommincia l'anno dì primo di luglio 1422, l. VI*

Giovanni tòsse la deta pigione al detto pregio adì d'aghosto 1422
[segue la somma dei pagamenti fino al 23 settembre per un totale di l. 1 s. 10]
La detta pigione si disfece ad' 23 di settenbre per fare le chappelle della chiesa nuova.

DOCUMENT 1422f

1422 **October 1. A house on *via de'preti* is demolished to make way for the Old Sacristy.** [ASL 2311, *Libro di entrata e uscita del Capitolo e ricordi del Capitolo di San Lorenzo, 1422*, c. 16v and v, from Pacciani, 1994, p. 95, Doc. 14 (brackets are Pacciani's); also quoted in *Donatello e la Sagrestia Vecchia*, 1986, p. 102; and Ruschi, 1989, p. 85, n. 1.]

Mona Tonia di Lapo vedova che porta la chalcina a vendere tiene a-pigione il palcho della sesta chasa posta nella via de' preti, pagha l'anno lire sei. Chomincia l'anno dì primo di giungnio 1422, 1.VI
[segue la somma dei pagamenti fino al 30 settembre per un totale di l. 2]
Andò a terra e disfessi per fare la sagrestia adì primo d'ottobre 1422

DOCUMENT 1422g

1422 **October 21. Record of payment to workers laying the foundations either for the Old Sacristy or adjacent double chapel.** [*ASCL 2311, c. 25*, October 21, 1422, from Saalman, 1993, p. 112, n. 20.]

Discussion: Although both the sacristy and chapel noted above were commissioned by Giovanni de' Medici, this document suggests that Cosimo de' Medici oversaw the work for his father.

Adi detto vende uno mezzo uscio e due pezzuoli di chorrenti a martino overo a maso di michele di falcho che fanno i fondamenti di chosimo per tutti s. quindicj s. xv.

DOCUMENT 1422h

1422 **November 12. Unknown document noting that the prior was Benedetto di Matteo Schiattesi**

Discussion: Elam, "Cosimo de' Medici…," 161 note 18; and Moreni, *Continuazione*, vol. 2, 355 (Elam, citing Moreni, notes the date as 11 November 1422; however, Moreni notes it as 12 November 1422). Need help identifying this document.

INTERPOLATED DOCUMENT 1423a

(1423) **Description of a fire that purportedly destroys the old basilica of San Lorenzo.** [F. L. Del Migliore, *Firenze: città nobilissima illustrata*, Florence, 1684; as quoted in Cianfogni, 1804, p. 193.]

Discussion: According to the account, the people of Florence illuninated an elaborate altar in the old basilica in the hopes of invoking divine protection from attack by Filippo Maria Visconti of Milan. The altar purportedly ignited the roof and destroyed the church. Although this account cannot be verified, it is repeated in two eighteenth century plaques in the church, both of which are probably based directly on Migliore's account. One of them, dated 1712, is located in the Cappella della Stufa (SP 42–SP 45). The other, dated 1738, is located in the Cappella Ginori in the north side of the nave (SP 71–SP 72; see discussion in Cianfogni, 1804, pp. 192–197). If there is any truth to the account, then the old church must have been repaired, for it is mentioned as late as 1461 (Doc. 1461c).

Comprendendosi la Chiesa di S. Lorenzo d' un' antichità, che passava mille anni, senza mai correr fortuna di restaurarsi, minacciando rovina, come accade ec. ella come venisse a cangiar sembiante, e la spoglia vecchia in quell' onoratissima fabbrica, che oggi si vede, non sarà se non bene ridirne il caso, che ne diede il motivo. Erasi conservata viva la memoria di quella promessa fatta da S. Ambrogio alla Città, per la quale volendosene implorare l'aiuto, allorchè conveniva far gagliarda difesa contro all'Arcivescovo di Milano (Giovanni Visconti) la Signorìa di quel tempo eresse quivi nella Chiesa vecchia in onor suo una Cappella; dove ritornate, che furono nel 1423. le armi in campo contro un fierissimo Principe pur Milanese, Filippo Maria Visconti; e in sul vigor della guerra ricorso il popolo con straordinario apparato di lumi a quell' Altare, s'attaccò fuoco alla soffitta, e senza riparo rese la Chiesa, che era già arsa dal tempo, e consumata dagli anni, contaminata per modo, che costrinse a pensare a cosa maggiore, e a rimuoverne la pianta, non senza comun dispiacere, per doversi distruggere un luogo si venerabile, e di tanta memoria.

DOCUMENT 1423b

1423 **May 31. More houses located along *via de' preti* are demolished "for the love of the new church."** [*ASL 2311, Libro di entrata e uscita del Capitolo e ricordi del Capitolo di San Lorenzo*, 1422, c. 17r, from Pacciani, 1994, p. 95, Doc. 13 (brackets are Pacciani's).]

Discussion: See Docs. 1418a, 1422e, and 1422f.

C. 17r
*Monna Verde di *** tiene a-ppigione il terreno della settima chasa posta nella via de'preti, pagha l'anno lire sei. Chommincia l'anno dì primo di giungno 1422, l. VI*
[segue la somma dei pagamenti per un totale di l. 5]
Anne dato adì ultimo di maggio s. dieci, il resto le lascia perche stette tre mesi che no-lla potev'adoperare, per amore della chiesa nuova, s. X

INTERPOLATED DOCUMENT 1423c

1423 **June. In a declaration dated 1447, Ugolino di Niccolò Martelli and his brothers refer to a provision in their father's will of June, 1423 for the construction of a chapel "together with others." The chapel, known as early as 1427 as the *Cappella degli Operai* (see Doc. 1427c), was still under construction at the time of the declaration.** [Catasto 1447, Fa. 678 f. 1411 v, from Pudelko, 1936, p. 60, n. 2.]

Discussion: Elam has determined that the Aldobrandini, Martelli, and Taddei families jointly owned the chapel in question beginning some time between April 1421 and April 1423, the period of time during which members of all three familes served simultaneously as members of the lay building committee of the church, thus making them *operai* (Elam, 1992, pp. 166-167).

Dichiarazione di Ugolino di Niccolò Martelli e fratelli (comincia f. 1409). *Abbiamo per testamento di nostro padre fatto insino lanno 1423 di giugno a dì VI roghato Gerontino da Montecatini dovesse fare a chomune chon altri una chapella per santo lorenzo la quale si lavorava al chontinuo e fa… ci tochera in nostra parte di spesa f. L…. incircha.*

DOCUMENT 1423d

1423 **July 21. Church document granting permission to the Rondinelli family to demolish their family chapel in the old basilica of San Lorenzo and to build a new one in a corresponding position in the new church, south of and adjacent to the high altar chapel.** [Moreni, II, 1817, pp. 358–360, source not cited.]

Discussion (a): The exact extent of the Rondinelli's responsibility became the subject of a controversy that was resolved by an arbitrator, Michele Frosini, rector of the spedale di S. Maria Nuova. According to the agreement he brokered, the Rondinelli could use the south wall of the high altar chapel, which consitutes the north wall of the Rondinelli chapel, without charge, but had to pay half the cost of the foundation of the wall between the Rondinelli chapel and the adjacent chapel to the south, to be built by Albizzo da Fortuna. Who was to pay the cost of the above-ground portion of the shared wall is not clear. (see Moreni, I, 1816, pp. 20–22; and Elam, 1992, pp. 165–166, 166 n. 38).

Discussion (b): This document indicates that the adjacent chapel to the south had already been assigned to the da Fortuna family.

In Christi nomine Amen. etc. Michael Fruosini Rector Hospitalis S. Mariae Novae de Florentia arbiter, et arbitrator, et amicus comunis electus et constitutus a D. Ioanne de Spinellinis canonico, et uno ex canonicis Ecclesiae S. Laurentii de Florentia sindico, et procuratore, et sindicario, et procuratorio nomine Prioriae, et canonicorum et Capituli Ecclesie S. Laurentii de Florentia ex parte una et ser Rainaldo Filippi, Vierio Andreae, Alexandro Michaelis Ghini, Andreae Reinaldi, Filippi, et... omnibus de Rondinellis, et de familia de Rondinellis ex parte, ut de compromisso in nobis facto a partibus supradictis constare vidimus publico documento manu ser Francisci ser Franc. Masi Not. Publ. viso igitur Compromisso pred., et alia...potestate nobis ideo a dictis partibus concessa et adtributa, et visa certificatione de dicto compromisso facta per Ghinum Michaelis Ghini de Rondinellis etc. Et auditis, intellectis, et examiuatis litibus, quaestionibus, differentiis dictarum partium, et quidquid dictae partes dictis modis, et nominibus coram nobis dicere et allegare, respondere, et obbicere voluerunt volentes dictas eorum lites dirimere, et ipsas partes ad concordiam reducere sedentes pro Tribunali in infrascripto loco voluntatem ipsarum partium sequentes, et sequi volentes his scriptis inter dictas partes dictis modis, et nominibus laudamus, pronuntiamus, et arbitramur in hunc modum, videlicet:

In primis quidem cognito, et reperto litem, quaestiones, et differentias fuisse, et esse inter partes predictas dictis modis, et nominibus occasione cujusdam Cappellae constructae factae, et edificatae, et creatae in Ecclesia S. Laurentii de Florentia sub nomine B. Andreae Apostoli per dictorum de Familia de Rondinellis, quae vulgariter dicitur, et nominatur la Cappella de' Rondinelli *ex eo quod destrui debeat pro uno edificio fiendo in dicta Ecclesia, as hoc, ut iter dictae Ecclesiae sit latum, liberum, et apertum, quae destructio egre subportatur per dictos de Rondinellis. Et cognoscentes quod commendabile, et honorificum est Deo et dictae Ecclesiae, et Capitulo, quod dicta destructio dictae Cappellae fiat, ad hoc, ut dictum iter dictae Ecclesiae sit honorabilius, volentes quod non obstante damno suportando in et circa dictam destructionem praedictorum de Rondinellis dicta destructio fiat, et ex adverso providere indepnitati, et honori dictorum de Rondinellis quantum in nobis est et etiam conservare indemnem Capitulum ante dictum praesente nostro Laudo, et arbitramento laudamus, pronuntiamus, et arbitramur, quod unum Podere positum in Populo S. Chirici de Marignolla Communis Florentini cam.... Item una domus posita Florentiae in Populo S. Laurentii de Florentia loco detto* al canto della Macine*, cui a primo via a.... quae sunt dictae Cappellae, et ad dictam Cappellam S. Andreae pertinent, et expectant pleno jure et omnia alia bona mobilia, et immobilia pertinentia ad dictam Cappellam vendantur, et vendi debeant, et possint per praedictos de Rondinellis, cui, et quibus maluerint pro majori pretio vendi poterint, dummodo tamen et cum hac conditione, videlicet, quod pretium ex inde percipiendum pro et de dictis bonis sic vendendis deponatur, et deponi possit, et debeat penes idoneam personam, prout et de* *qua erunt in concordia Capitulum praedictum, Andreas Verj et Andreas Rinaldi de Rondinellis, et non aliter, vel alio modo, quod pretium, et seu quae pretia sic percipienda, et deponenda expendi possint, et debeant in construendo, et construi faciendo loco dicte Cappelle sic destruendae aliam Cappellam in dicta Ecclesia, et in illo loco dictae Ecclesiae, de quo sunt in concordia dict. Capit. et de familia de Rondinellis, videlicet penes Cappellam majorem dictae Ecclesiae noviter erigendae ex latere ex quo est dicta Cappella S. Andreae ad praesens existens in dicta Ecclesia. Et in aliis minime converti, vel distribui possit ullo modo declarantes, arbitrantes, et laudantes ad cautelam, quod Cappella de Rondinellis praedicta sive noviter erigenda possit regere, et se substentare super murum Cappellae majoris dictae Ecclesiae absque aliqua contraditione fienda per dictum Capitulum dictae Ecclesiae. Item considerantes quod dicta Cappella S. Andreae de Rondinellis sic erigenda, et construenda, ut supra dictum est, remanebit absque aliqno reddito percipiendo per Cappellanum dictae Cappellae volentes providere indemnitati dicti Capituli quantum in nobis est, et etiam dare modum quod praedicti de Rondinellis habeant dictam Cappellam reammissam laudamus, pronuntiamus arbitramur, quod donec et quousque dicta Cappella noviter erigenda, et construenda stabit absque redditu occasione praedicta tempore vacationis eligatur, et deputetur...Cappellanus in dicta Cappella modo infrascripto, videlicet, quod Prior, canonici et Capitulum dictae Ecelesiae quandocumque contigerit dictam Cappellam vacare eligant, et eligere debeant tres in Sacerdotio constitutos, idoneos, habiles, et capaces dictae Cappellae et honestae, ac laudabilis vitae, et famae, quorum tamen sic electorum dicti de Familia de Rondinellis accipiant, et seu eligant unum ex ipsis tribus, quem maluerint, et ipse talis sic acceptatus, et electus per eos remaneat, et remanere debeat Cappellanus perpetuus dictae Cappellae; et per dictum Capitulum debeat recipi, et admitti in Cappellanum, et pro Cappellano praedicto et per dictum Cappellanum, et per dictum Capitulum debeat provideri, quod ibidem officiare possit declarantes ad cautelam, quod unus Cappellanus tantum, et non duo sint, et remaneant in dictis Cappellis....stantibus praedictis, et infrascriptis. Item in casu quo temporibus futuris adciderit quod dicti de Familia de Rondinellis, vel aliquis eorum aliquam donationem, vel redotationem fecerit dictae Cappellae de aliquibus bonis, ex quibus Cappellanus dictae Cappellae ex redditu annuali perciperet tantum quod Cappellanus dictae Cappellae posset commode vivere ad arbitrium boni, et discreti viri, et a dicto tempore sic facerent in antea dicti de Familia de Rondinellis possint, et debeant eligere unum Cappellanum dictae Cappellae tempore vacationis unum in Sacerdotio constitutum idoneum habilem, et capacem ad dictam Cappellam tenendam, et gubernandam bonae vitae, et laudabilis famae prout eis videbitur, et placebit. Quem Cappellanum Prior, Capitulum praedictum confirmare possint, et debeant prout hactenus sunt consueti. Item considerantes, quod praedicta Cappella de Rondinellis noviter erigenda, ut dictum est, posset accidere, quod domus aliqua emi deberet, volentes providere indemnitati dictis de Rondinellis, et voluntatem dictarum partium sequentes condemnamus dictum Capitulum ad conservandos dictos de Familia de Rondinellis indemnes et penitus sine damno ab omni, et toto eo, quod expendi continget occasione supradicta; vel hactenus expensum fuisset occasione praedictorum. Item cum inveniamus quod dictum Capitulum S. Laurentii tam per ea, quae supradicta sunt, quam per ea quae a dictis partibus audivimus promisit dictis de familia de Rondinellis facere, et curare ita et taliter, quod Cappella... sic noviter erigenda in loco, ubi supradictum est consignaretur eis per Operarios dictae Ecclesiae volentes quod dictis de Rondinellis promissa dicta conserventur omni modo.... condepnamus dictum Capitulum ad faciendum et cnrandum ita et taliter quod dictum locum pro fieri faciendo Cappella predicta consignetur ipsis de familia de Rondinellis firmis tamen stantibus omnibus dictis, ita tamen quod predicti de Rondinellis solvere teneantur, et debeant Camerario Operariorum dicte Ecclesie medietatem ejus quod expendet dictus Camerarius in fieri faciendo murum fundamenti facti inter Cappellam predictam fiendam per dictos de Rondinellis et Cappellam fiendam per Albizum de Fortuna in dicta Ecclesia. Latum anno ab Incarnatione Domini millesimo quadrigentesimo vigesimotertio Ind. I. die vigesima prima mensis lulii ipso Michaele ad cautelam pro tribunali sedente Florentie* *in domo Hospitalis S. Marie Nove de Florentia presentibus Reinaldo Philippi de Rondinellis, et Dom. Benedicto Priore dicte Ecclesie, et presentibus testibus etc.*

INTERPOLATED DOCUMENT 1423e

1423 **September (this date is referred to in a document of 23 May 1433). The church prior, Matteo Schiattesi, is authorized to allocate patronage to the transept chapel next to the northern side door of the nave (SP 60—SP 63).** [Transcribed in: Elam, 1992, p. 167.]

Discussion (a): The assignment of the Rondinelli Chapel in July 1423 (Doc. 1423d) left the future Cappella Luca di Marco as the last unassigned chapel in the transept. The present document perhaps reflects an attempt on the part of the church to find this last patron in order to avoid construction delay. Nevertheless, the chapel would not be assigned until May 1433 (see Doc. 1433a). Elam writes:

> "The prior had already in September 1423 been given authority to allocate this chapel, described as 'next to the campanile of the said church and next to the chapel to be made by the heirs of Zanobi di ser Gino'." [See Elam notes: could mean "next to the nave"]

Discussion (b): This document indicates that construction of the Cappella Ginori (the double chapel at the north end of the transept) had not yet begun.

DOCUMENT 1423f

1423 **May 18.** The prior and chapter allocate to Ser Giovanni Bonaiuti a place "pro porta sive ianua que dicitur la porta della via della stufa usque ad tabernaculum nostre donne quod dicitur factum per magnificam potentiam florentinam excepto chiusuro sepulture illorum della stufa." (in front of the door or opening which is called the door of the via della Stufa up to the tabernacle of Our Lady which [i.e. tabernacle] is said o have been made by the Florentine government, excepting the lid of the burial place of the della Stufa). Bonaiuti can construct an altar with a tabula and predella and a scaglione of wood. He must not break the wall of the church unless the prior and chapter make a new decision. The condition is

> 'quod si quantum aliquo tempore contigeret quod cappelle crescerent et fierent per modum quod in dicto loco foret necesse fieri cappella ad similitudinem aliarum quae ibidem fierent pro ornamento et augmentatione dicte ecclesie' (that if at any time it should happen that the chapels should grow in number and it should become the case that in the said place it would be necessary that a chapel should be made similar to the others that were being made there for the ornament and enlargement of the said church) – then Buonaiuti and his heirs should be required to build such a chapel and if they fail to do so within one year or more as the canons see fit, the prior and canons can allocate a more convenient place in the church for this altar.]

Discussion: inserted directly from Elam e-mail; needs to be edited. See also Moreni, vol. 2 [evidently Vol. 1], 119-120.

DOCUMENT 1424a

1424 **July 3. Codicil of Albizzo di Toso da Fortuna, allocating 500 florins for the construction of a chapel dedicated to S. Paolo, to be completed within five years.** [*ASF Pupilli avanti il Principato, 41, c.137v*, from Pacciani, 1994, p. 95, Doc. 16; See discussion in Elam, 1992, p. 166, n. 39.]

> *…Actum Florentia in domo infrascripti Albizi presentibus domino Benedetto Mattei Schiattensibus priore Sancti Laurentii de Florentia, ser Luca Lapucci presbitero dicte ecclesie Sancti Laurentii, Francischo Angeli de Civitatis Castelli chericho in dicta ecclesia Sancti Laurentii* [...] *Itme voluit disposuit et ordinavit dictus Albizus pro remedio anime sue et suorum mortuorum quod quedam cappella eiusdem Albizi posita in ecclesia Sancti Laurentii iam incepta hedificari compleatur et eidem cappella detur perfectum opus et finis contructionis cum altare et ornamentis et aliis necessariis et opportunis ad celebrandum et itaque possit celebrari divinum offitium. Et propterea voluit idem Albizus expendi de bonis suis per eius filios et heredes florenos quingentos auri* (…) *infra quinque annos proxime futuros a die obitus dicte Albizi codicillatoris predicti, expendendo quolibet anno dictorum quinque annorum florenos centum auri et non ultra quoquo modo in hedificatione constructione et ornamentis necessariis et opportunis dicte cappelle* (…) *et disposuit quod dicta cappella* (…) *appelletur et niminetur la cappella di San Pagolo….*

DOCUMENT 1424b

1424 **September 15. Record of the election of *operai* of San Lorenzo noting that construction of the church continues.** [*Codice 53 (già M. 1211) della Serie II delle Carte Strozziane del R. Archivio di Stato Firenze*, p. 87, from Ginori Conti, 1940, p. 47, n. 1, and p. 58.].

> *…electi in operarios nove constructionis que fit continue….*

INTERPOLATED DOCUMENT 1425a

(1425) **No month cited. Excerpt from a church resolution of November 20, 1440 noting that construction work on the new basilica of San Lorenzo had been suspended approximately fifteen years earlier due to the financial pressures of war taxation.** [See Doc. 1440c.]

> *...et cum hoc sit, quod jam sint anni quindecim, vel circa, quod in dicta majori cappella non fuerit aliquid edificatum, sed sit, et fuerit talis cappella, et tale opus propter necessitatem pecunie penitus derelictum; et cum ex predictis, non solum edificio dicte majoris cappelle, ut dictum est, incepte, verum etiam dicte sacrestie et cappelle celeberrime jam fere perfecte per famosissimum virum Joannem Adovardi de Medicis, et Cosmam, et Laurentium eiusdem Ioannis prestantissimos filios, et aliis cappellis jam inceptis, et non perfectis per particulares cives, et populares ecclesie dicti S. Laurentii ex ultraque parte dicte majoris cappelle detrimentum, imperfectio, et retardatio sequatur, et resultet in vilipendium, et ignominiam totius dicti populi...*

INTERPOLATED DOCUMENT 1425b

(1425) **August 16. Description of a ground breaking ceremony at San Lorenzo, purportedly held in 1425.** [F. L. Del Migliore, *Firenze: città nobilissima illustrata*, Florence, 1684 (no page number provided); as quoted in Cianfogni, 1804, pp. 197–198.]

Discussion: According to this account, the ceremony is attended by all the Florentine nobility, and is conducted by Archbishop Amerigo Corsini. As part of the ceremony, Corsini drops gold and silver medallions into the foundation hole. The lavish event nearly triggers a class riot. In light of more reliable evidence that another foundation ceremony took place in 1421 (Doc. 1421a), however, that construction was suspended in 1425 (Doc. 1425a), and the questionable nature of Del Migliore's account of a fire in the old basilica of San Lorenzo in 1423 (Doc. 1423a), the reliability of this account cannot be determined. (On class relations in *quattrocento* Florence, see: Molho, 1979, pp. 9–18.)

Nel venirsi all'atto del buttarne il primo fondamento, accadde cosa da non doversi tralasciare a questo proposito, ridettaci da chi si trovò presente; ed è, che il popolo istigato, e messo sù, come si credette da alcuni principali di quella Parrocchia, più per invidia contro a chi col danaro alla mano si metteva ad un' impresa così onorata, e di nome; che per difesa di veder conservate le memorie venerabili, e così grate alla Città, come era quella, minacciò di muoversi armato, ogni volta che si fosse veduto muover di lì pure un sasso; di sorte che convenne reprimere l'ardire di chi in quel tempo di Repubblica ardiva superbo di alzare la testa, senza rispetto a quel che s'era decretato dalla Signoria nel 1425 severissimamente imponendo silenzio a qualunque persona di grado, e molto più in muoversi contro a quall' atto, a cui i trasgressori sottoponevansi a pena della testa. Si venne dunque a farne la funzione solenne in quell' anno; alla quale, come era solito nelle cose grandi, fù presente tutto quel Senato, la Nobilità, e i principali dello Stato, coll' Arcivescovo Amerigo Corsini, che servato l'ordine delle ceremonie, calò giù ne fondamenti alcune medaglie d'oro, e d'argento, improntate con che figure, e lettere, non lo dice chi ne trasmesse la notizia. Questo seguì ne 16. d' Agosto: e si nota, che la mattina precedente fattavi per bando convocazione di tutto il Popolo, fè ordinato stessero assistenti in sulla piazza di S. Lorenzo i sedici Gonfalonieri delle Compagnie, armati sotto i loro pennonieri, acciò si togliesse il sospetto, che ebbero i Padri, non vi si rinvigorissero con tumulto, e sollevazione le gare non spente, ne piegate alla volontà unitasi con molti in quell' atto.

DOCUMENT 1426a

1426 **January 12 (new style). A contract is written in the Old Sacristy.** [ACSL 2303, c. 57, from Saalman, 1993, p. 112, n. 21.]

Discussion: That a meeting was held inside the sacristy suggests that the overall structure of the building had been largely completed, and that work on Donatello's stucco roundels—probably a messy operation that would have rendered the sacristy unfit for meetings—had either already been completed or not yet begun. [Was there still a sacristy in the old basilica?]

...nella sagrestia di santo lorenzo.

DOCUMENT 1427a

1427 **No month cited. Tax report of master mason Filippo di Giovanni reporting that he is at work with other masons, in the employ of Giovanni de' Medici, at the church of San Lorenzo.** [Sources as noted.]

Discussion: The report evidently refers to work on the Old Sacristy and the adjacent double chapel, which were the portions funded by Giovanni de' Medici, and the only portions that continued to rise after the general work stoppage of 1425 (see Doc. 1425a).

"Filippo di Giovanni reports that he is at work with 'altri maestri suoi chonpagnj' at the 'muramento di giovanni de medicj in san Lorenzo.'" [*ASF, Catasto 78 (1427), c. 318*, quoted with commentary from Saalman, 1993, p. 112]

"…Filippo di Giovanni, who worked on the dome of S. Maria del Fiore…in his portata al catasto, or tax return, or 1427 he declared that he had an income of 70 gold florins, to be divided with other men, working 'al muramento di Giovanni de Medici in san Lorenzo che s'abattono'…" [quoted with commentary from Battisti, 1981, p. 352 n. 1.]

DOCUMENT 1427b

1427 **No month cited. Tax report of Lorenzo d'Andrea di Messer Ugo della Stufa noting that he and his brother Giovanni Loteringo began construction of a chapel in San Lorenzo "before the war began."** [*ASF, Catasto 50, c. 165v*; from Saalman, 1993, p. 441, Doc. 22.]

Discussion: Since construction on most of the basilica was suspended in 1425 due to the pressures of war taxation (see Doc. 1425a), we may assume that the chapel was begun before that date. The names of the original patron or patrons of this chapel appear in several different forms in the literature. In addition to those cited above, whom Saalman notes were brothers, Moreni names only a single original patron: Andrea di Lotteringo di Ugo della Stufa (Moreni, 1806, I, p. 97). A *sepoltuario* of 1463 (quoted in Elam, 1979, p. 185, Doc. G) similarly names a single patron: *andrea di lotteringho di m.ugho della stufa* (see Doc. 1463a). According to Elam, the chapel "was a consorterial chapel undertaken primarily by Giovanni di Lorenzo and Lotteringo di Andrea di Ugo della Stufa" (Elam, 1992, p. 165, n. 36).

Incarichj

Abiamo tolto affare I[a] chapella Giovanni Loteringo et io et comincciamola inanzi la guerra chomincassi in salorenzo che chostera da fl. 600 et tochamene il terzo / e ora a murare sene spendera di fl. 300 tocchami il terzo

fl. –

DOCUMENT 1427c

1427 **No month cited. Excerpts of two tax reports, one of Aldobrandino di Giorgio Aldobrandini, the other of Taddeo di Filippo Taddei, which note that construction of the *Cappella degli Operai* was underway.** [From Elam, 1992, p. 167, n. 44, sources as noted.]

Discussion: These two documentary excerpts provide partial confirmation of the joint ownership of the *Cappella degli operai* by three families—the Martelli, Aldobrandini, and Taddei—as noted in a *sepoltuario* of 1463 (Doc. 1463a). The second excerpt contains the earliest known reference to this chapel by this name (see Doc. 1422c, discussion).

"190 florins to be spent '*de quali danari ne fo murare una chapella nella chiesa di S. Lorenzo la quale si mura tutavia e nella detta chapella si spende tutta la detta quantità et molto più saranno*'" (tax report of Aldobrandino di Giorgio Aldobrandini from: *ASF Catasto 48*, fo. 16v).

la chapella di santo lorenzo di firenze che ssi mura per gli operai resta avere damme— fl.185 (tax report of Taddeo di Filippo Taddei from: *Catasto 51*, fo. 1286r, *incarichi*)

DOCUMENT 1427d

1427 **No month cited. Tax reports of the da Fortuna family noting that the family chapel is not yet finished.** [Saalman, 1993, p. 437, Docs. 2.1 and 2.2, sources as noted.]

Discussion: The following excerpts from two tax reports of 1427 are reproduced here verbatim, including all notes and numbers, from Saalman (above). The first document refers to an endowment for the chapel "when it is completed" (*quando sia compiuta*). The second refers to an endowment to take effect "when a chapel in San Lorenzo is done" (*quando fu fatta una capella in san lorenzo*). Brackets below, except the first set, are Saalman's. Italics are mine.

"1427 […] tax reports of Toso di Albizzo di Toso (aged 30) and Bartolomeo (aged 5 1/2) and Girolamo (aged 4) di Lotto di Albizzo di Toso da Fortuna

1 Toso, 1427: *per ufficiare la chapella in san lorenzo quando sia compiuta lanno fl. xxx chelli tochera il I/4 fl. 7 I/I i quali saranno a dare a uno prete che luficj.*

[Chapel held by Toso in common with his nephews Bartolomeo and Girolamo and Giovanni and Francesco di Albizzo, his brothers
(ASF, Catasto 78, c. 72)]
(ASF, Catasto 78, c. 491v)

2 Bartolomeo and Girolamo, 1427: *Ancora abiamo di gravezza orgnano per sempre il 1/4 di fl. 30 denari E questo debbe cominciare quando fu fatta una cappella in san lorenzo dove ancora vabiamo a spendere in circha di fl. 400 darnari tochera a noi fl. 100 d. I detti fl. 30 anno aesser per 1º cappellano per ufficiare detta cappella… fl. 7 1/1 anaessere ognanno.*
(ASF, Catasto 48, c. 326v)"

DOCUMENT 1427e

1427 **November 27. Record of the appointment of syndics in the *gonfalone del Leon d'Oro* for the purpose of collecting back taxes, to be used to defray construction costs of the high altar chapel.** [*ASFi., Notarile anticosimiano*, M 546 (1427–46), ff. 7 r-v, November 27, 1427, from Molho, 1979, p. 27, n. 52.]

Discussion: This document may reflect an attempt to re-start construction of the church after it stalled in about 1425 due to the pressures of war taxation (see Doc. 1425a).

Residuo vero dictarum pecuniarum exigendarum ut supra per dictos sindicos et seu que ad eorum manibus pervenient in futuro, factis primo solutiones suprascriptis et restitutiones ut supra dictum est et non prius possint et debeant dicti sindici et operarii expendere et expendi facere in muramento et constructione maioris cappelle dicte ecclesie S. Laurentii et pro ipsius constructionis que cappella fit per populanos dicte ecclesie et eo modo et forma prout eis videbitur et placebit et in hoc eorum conscientias honerandum.

DOCUMENT 1427f

1427 Catasto 49, 453r

Ser Giovanni Bonaiuti

Declares a Monte credit of 525 florins the interest on which is to be used perpetually 'per uno cappellano perpetuale il quale a essere diputato a ufficiare uno altare il quale io o fatto fare nella chiesa di Sa Lorenzo alato alla porta che va nella via della stufa'.

Discussion: inserted directly from Elam e-mail; needs to be edited.

DOCUMENT 1428a

1428 **No month cited. Incision in original pietra serena cupola lantern cap.** [Original cap is on permanent display on the cloister balcony; For photographs see *Donatello e la Sagrestia Vecchia*, 1986, p. 16, Fig. 1; and Saalman, 1993, p. 134, Pl. 72.]

1428

DOCUMENT 1428b

1428 **November 8. Church document recording an endowment by Giovanni de' Medici of two new canonries in the church of San Lorenzo, one dedicated to Saints Cosmas and Damiano, and the other to Saint John the Evangelist.** [Moreni, 1817, II, pp. 361–368, source not cited.]

Discussion: The endowment, finalized in a meeting held in the Old Sacristy, which the document describes as "sumptuous and newly built" (*sumtuoso de novo edificari*), consists of the donation to the church of a farm in S. Lucia, located outside the walls of the city (*extra muros Civitatis Florentie*) to the northwest, and 2400 florins, deposited in the *Monte Comune di Firenze*. The endowment signals the completion and dedication of the sacristy and adjacent double chapel, which were built by Giovanni de' Medici, with the involvement of his sons, Cosimo and Giovanni. Among the conditions of the endowment is the provision that the canons celebrate the feast days of Saints Cosmas and Damiano in the newly completed double chapel dedicated to these saints–a practice that continued until November 7, 1482 (Moreni, I, 1816, p. 23, n. 1). The feast day of Saint John the Evangelist, the saint to which the adjacent Old Sacristy is dedicated, is also to be observed. The endowent brings the total number of canons of the church to eleven. Giovanni personally selected the two new canons, Antonio di Bellincone degli Agli, and Lorenzo di Giovanni da Pisa (Moreni, I, 1816, pp. 22–24). The chapter evidently considered the endowment to be insufficient for the support of two new canons and the new liturgical responsibilities required of them, for the endowment was augmented two years later (see Doc. 1428c).

In Nomine D. N. I. C. ejusque Matris Virginis Mariae, et B. Iohannis Evangelistae, et SS. Cosmae, et Damiani, nec non B. Laurentii M. et totius Celestis Curiae Paradisi Amen. Anno Domini sue salutifere Incarnationis MCCCCXXVIII. Ind. XII. die VIII. Mensis Novembris secundum cursum, et morem Florentinorum [November 8, 1428]....

Sane pro parte dilecti filii Ioannis Bicci de Medicis Civis Florentini nobis nuper exhibita petitio continebat, quod ipse qui de bonis sibi creditis aliquam in celestibus partiunculam dirigire gestiens, apud Ecclesiam S. Laurentii Florent. in qua preter Priorem ejusdem, novem canonicatus et totidem Prebende fere noscantur notabilem cum duabus inibi pro celebratione Missarum Cappellis Sacrestiam opere non modicum sumptuoso de novo edificari, et construi facere cepit ad ipsius incrementum Cultus, ac pro sue ejusque parentum, et amicorum animarum salute de ejusmodi bonis in Ecclesia ipsa cum Prioris prefati, nec non dilectorum filiorum Capituli ejusdem Ecclesie, vel ipsorum majoris partis consensu duas de novo Prebendas pro totidem canonicis illas cum canonicatibus inibi, et rationabilibus adiacentiis et honoribus pro tempore obtenturis creari, et institui facere, et competentem pro eis dotem assignare, et donare proponit, affectans quod iuspatronatus, et presentandi idoneas, que per Priorem et Capitulum pred. inibi instituantur, pro tempore, personas ad ejusmodi creandas Prebendas, hac prima vice, et quoties in antea vacaverint Iohanni pred. pro se, suisque Successoribus, et heredibus perpetuo reservetur....

Que bona pro dd. Prebendis sic assignata sunt infrascripta, videlicet: unum Podere cum domo positum in Populo S. Luciae Omnium Sanctorum, extra muros Civitatis Florentie stadiorum triginta septem, vel circa ad cordam terre laborative, et cum arboribus fruttiferis, cui a 1. via, a 2. Magistri Iohannis de S. Miniate, a 3. consortium Molendini Omnium Sanctorum, a 4. Hospitales S. Mathei vulgariter *nuncupati* di Lemo da Monte Catino *infra predictos confines, vel alios plures, vel meliores, aut veriores....*

...vel etiam inter Cappellanos de bonis, vel redditibus Capituli vel pertinentibus ad Mensam Capituli distribui, et que dari debent per ipsorum D. Prioris, et canonicorum distributorem, vel alium ad id deputatum infrascripta bona, videlicet quoddam Creditum duorum Milium quatuorcentorum Florenorum descriptorum super Montem Comunis Florentie vulgariter nuncupati Monte de' cinque Interi *ex quibus percipiuntur anno quolibet Floreni centum viginti auri. Sicque Venerabiles viri Dom. Benedictus Mathei de Schiattensibus Prior, D. Nerius Andreae, D. Franciscus Antonii, D. Baltassar Magistri Antonii, D. Bartolomeus Andree, D Iohannes de Spinellinis, D. Bernardus Iohannis, D. Iohannis Bartos lomei canonici Ecclesie S. Laurentii prelibati capitulariter congregati mandato d. D. Prioris in Sacrestia ipsius Ecclesie, et loco Capituli, et ubi negocia, et tractatus ipsius Ecclesie, et Capituli hactenus solita sunt fieri ad sonum Campane...*

Item predicti duo canonici modis predictis eligendi, et presentandi, et instituendi, et assumendi, et eorum successores habeant, et habere debeant residentiam, Cameras, et habitationes in d. Ecclesia S. Laurentii quemadmodum habent, et habere consueverunt alii veri, et antiqui canonici Ecclesie ante dicte, si ad presens tales habitationes, vel Camere existerent, vel cum primo esse contigeret.

Item quod in Cappella SS. Cosme, et Damiani, que est penes Sacrestiam novam dicte Ecclesie, et in Cappella S. Iohannis Evangeliste existentis in dicta nova Sacrestia d. Ecclesie constructis, et edificatis per d. Iohannem ad incrementum Divini Cultus in Ecclesia memorata, et pro sue, suorumque parentum, et amicorum, animarumque salute in perpetuum per dd. duos canonicos ad illas assumendos, et presentandos per d. Iohannem, et successive in posterum per suos heredes, et successores confirmandos, instituendosque, ut predicitur, per d. D. Priorem, et Capitulum d. Ecclesie Misse dicantur, ac devote celebrentur, et hoc modo, videlicet: Quod in Cappella SS. Cosme, et Damiani per alterum de dd. canonicis sic ad dd. novas Prebendas assumptis singulis diebus ad minus una Missa dicatur, ita quod una die celebret ibi unus, et alia die alius, vel prout invicem duxerint convenendum. Salvo tamen casu infirmitatis ipsorum, vel alterius eorum; quo casu alter sanus nihilominus sua vice dicere teneatur saltem de duobus diebus uno, et sic una die unus ipsorum canonicorum dicat unam Missam illa die, et postea una die intermedia celebret alius aliam, ut singulis duobus diebus saltem una Missa ibi celebretur. Sicque dd. duo canonici in dd. Missis celebrandis succedant gradatim, vet etiam prout alter ad invicem convenerint, dummodo numerus dd. Missarum dicendarum in dd. Cappellis, ut predicitur, non deficiat, nisi d. casu infirmitatis eveniente. Et in casu quod dd. duo canonici, et quilibet eorum, et eorum successores in perpetuum predicta omnia non observarent eo modo, et forma, ut prefertur, tunc Sacrista d. Ecclesie S. Laurentii pro tempore existens sub pena perjurii teneatur, et debeat apuntare quemlibet contra facientem pro qualibet vice, qua defecerit, et predicta non observaverit in solidis quinque convertendis per d. Sacristam in celebratione Missarum ad dictas Cappellas per idoneas personas in d. Ecclesia non residentes, nisi providerent per ipsos, et seu per alterum ipsorum, quod in dd. Cappellis Misse celebrarentur per Priorem, seu per unum ex canonicis d. Ecclesie modo, et forma predictis. Et an legiptimum infirmitatis impedimentum fuerit, vel ne stetur declarationi D. Prioris, et Sacriste ipsius Ecclesie modo, et forma predictis, et Iohannis dum viveret, et eo mortuo, suorum eredum, et successorum....

Item quod prefati canonici, et eorum successores, et quilibet eorum teneantur, et debeant in perpetuum in vigilia Festi Sanctorum Cosme, et Damiani dare Sacriste tres cereos ponderis librarum sex Cere, et duos ponderis librarum duarum, duarumque pro quolibet in vigilia Festi S. Iohannis Evangeliste accensuros in totis officiis duorum Festorum pro dd. Festis, et eorum quolibet honorandis, ao etiam facere Colationem de mane tantum condecentem toti Capitulo, Cappellanis dicte Ecclesie, et quolibet die dictorum Festorum et cujuslibet, vel alterius eorum....

Longe plura, et ampliora sequebantur utpote quo pacto commemoratio SS. Cosme, et Damiani, et S. Iohannis fieri debeat, et ipsas canonicorum electiones, et presentationes. Que omnia tanquam a re nostra aliena scribere recusavi.

Ego ser Iacobus Antonii de Romena Imperiali auctoritate Notarius, et Iudex

Ordinarius, Notariusque publicus Florentinus predictis omnibus, et singulis, dum sic agerentur, interfui, eaque rogatus scripsi, et publicavi, ideoque me subscripsi.

DOCUMENT 1428c

1428 **After November 8, 1428. *Ricordo* confirming the endowment of two new canonries by Giovanni de' Medici (see Doc. 1428b).** [Florence, *Biblioteca Medicea Laurenziana, ASL 2866, Filza di quaderni di Ricordi*, 1389–1533, c. 2r, from *Donatello e la Sagrestia Vecchia*, 1986, p. 102; also quoted in Ruschi, 1989, p. 85 n. 7.]

[...] *Richordo come a dì 8 di Novembre 1428 el nobile hu[om]o Giovanni di bicci de medici nella n[ost]ra sacrestia co[n]stituto dinanzi a m. Ja[co]po di nicolò piovano di s. Giovannj in petroio co[m]misario ap[osto]lico adomandò potere creare due p[re]bende a duo cano[n]icati i[n] San L[orenz]o e detto m. Ja[co]po dè lichentia e così creò detti canonicati e p[er] dote co[n]segnò loro i[n] dote uno podere posto fuori de la porta al prato nel p[op]olo di S.Lucia f[iorini] 38 panora 10 pugnora. 7 b[raccia], 2 1/2 con casa di lavoratore.*
E di poi i[m]mediate donò al cap[ito]lo p[er] rico[m]pensatione delle distributioni f[iorini] 2400 di mo[n]te di cinq[ue] de' quali si ritira l-anno f[iorini] 120...

DOCUMENT 1429a

1429 **(January—March 1428, new style?). Ricordo confirming the donation of 800 florins by Cosimo and Lorenzo de' Medici for the maintenance of the feast of S. Cosimo and S. Giovanni.** [Florence, *Biblioteca Medicea Laurenziana, ASL 2866, Filza di quaderni di Ricordi*, 1389–1533, c.2r, from Ruschi, 1989, p. 85 n. 7.]

Discussion: Since the Medici double chapel adjacent to the Old Sacristy was dedicated to Saints Cosmas and Damiano, and the Old Sacristy was dedicated to Saint John the Evangelist, this document, which provides for the feasts of S. Cosmas and S. Giovanni, confirms that the double chapel and sacristy were both completed by 1429, and were thus carried out as an integral construction project. The decorative terracotta frieze that encircles both the double chapel and Old Sacristy, but no other parts of the basilica, provides addition confirmation of this contemporaneous construction. Since the document provides the year but not the month, it could refer to a date in January, February or March, 1428, new style.

f[iorini] *800 di monte p*[er] *la festa di S.Cosimo e di S.Giovanni. Richordo come nel 1429 Cosimo e Lorenzo de medici donar*[ono] *al cap*[ito]*lo f*[iorini] *800 di mo[n]te di cinque interi co*[n] *obligo d-una festa di s.cosimo e damiano e di s.giovanni evangelista e ogni lunedì uno off*[izio] *p*[er] *l-ani*[m]*a di d*[ic]*to giovanni loro padre.*
Carta p[er] *mano di m.fra*[nces]*co di m.tomasso masi.*

DOCUMENT 1430a

1430 **January 21 (new style). Excerpt from church document recording Cosimo and Lorenzo de' Medici's agreement to augment Giovanni de' Medici's endowment of 2400 florins by one third, or, an additional 800 florins.** [Moreni, II, 1817, pp. 368–371, source not cited.]

Discussion: This document confirms that Giovanni had recently built the double chapel and sacristy "simultaneously" (*...due nobilissime, et sumtuose Capelle constructe nuper simul cum una ornatissima Sacristia in d. Ecclesia per d. spectabilem, et egregium Virum Ioannem*...). In addition to the conditions of the original endowment set forth by Giovanni in 1428, his sons Cosimo and Lorenzo add the new condition that the canons observe the anniversary of their father's death. (See Docs. 1428b and 1428c; and discussion in Moreni, I, 1816, p. 27.)

...Et considerantes, quod quia in dd. distributionibus cotidianis gravabatur Ecclesia, et Capitulum antedictum, et in dd. distributionibus extraordinariis particulariter gravabantur d. Dominus Prior, canonici, Capellani, et Clerici d. Ecclesie, d. spectabilis, et egregius Vir Iohannes, ut omnibus gravaminibus supradictis satisfaceret, et provideret, consignavit d. D. Priori, et Capitulo, et Ecclesie predicte Flor. duo milia quadrigentor. scriptor. in Monte, et super Monte Civitas Flor., ex quibus annuatim habentur Floren. centum viginti. Et quia in cotidianis distributionibus dd. duorum canonicorum occupantur tantum Floreni septuaginta tres, vel circa, et in festivitatibus SS. Cosme, et Daminani, et S. Iohannis Evangeliste Floreni decem, vel circa, prout ab eo ordinatum fuit per supradictum D. Priorem, et Capitulum, restant ex dd. Florenis centum viginti pro satisfatione dd. onerum particularium Flor. triginta septem, vel circa, et dd. Dominus Prior, et canonici cupientes in omnibus, prout supra est, Divinum cultum in d. Ecclesia ampliare et accrescere, de ipsis, seu ipsorum parte in hunc modum providerunt, et deliberaverunt videlicet: quod in festivitatibus SS. Cosme, et Damiani, et S. Iohannis Evangeliste, quia in honorem ipsorum due nobilissime, et sumtuose Capelle constructe nuper simul cum una ornatissima Sacristia in d. Ecclesia per d. spectabilem, et egregium Virum Ioannem; ac in festivitatibus SS. Marci Pape, et Amati Abbatis, pro eo quod corpora ipsorum per manus Beatissimi Ambrosii doctoris in presenti Ecclesia condita sunt, nec non et Sixti Pape martiris pro eo quod magister fuit triumphantis martiris Laurentii Patroni nostri, ac etiam maior Capella d. Ecclesie S. Laurentii constructa fuit in honorem ipsius, pro qualibet hora dd. festivitatum distribuantur Sol. quinque illis computatis, qui solent usque in presenti distribui secundum Constitutiones antiquas d. Ecclesie. Et quod in die Commemorationis omnium Defunctorum dividantur libre quinque inter interessentes Misse, et Officio, et libre quinque inter celebrantes et eo modo, et forma, prout fit in die Palmarum. Et quia per nobiles et Magnificos Viros Cosmum et Laurentium fratres et filios antedicte optime memorie spectabilis et egregii Viri Iohannis Biccii de Medicis ultra dictos florenos MCCCC. per dictum eorum patrem consignatos, fuerunt consignati dicto Domino Priori, et dicto Capitulo, et spetialiter sacristie dicte Ecclesie S. Laurentii Flor. octingenti descripti in Monte, et in libris, et super libris Montis Comunis Florent., ex quibus annuatim habentur Floreni quadraginta auri pro augmentatione Divini cultus, et salutis remedio anime supradicti eorum patris, et officiis celebrandis in d. Ecclesia quemadmodum placuerit, et visum fuerit DD. Priori, et canonicis, et Capitulo: supradictus D. Prior pro se, et pro Presbitero Nerio Andree uno ex dictis canonicis, cujus vocem, et vicem habet in commissione, ut constat manu mei Notarii infrascripti, et nomine suo, et D. Presbiteri Nerii, et DD. canonici volentes dictum Divinum cultum augmentare, et ad salutem anime d. spectabilis, et egregii viri Iohannis, ac animarum supradictorum filiorum suorum, ut tententur, pia intentione salubriter procurare in hunc modum ordinaverunt; videlicet pro quolibet anno in perpetuum prima die Mercurii, que venit inter X. et IIII. Kal. Martii, in qua celebrata fuit magnifica seppultura ipsius Iohannis officium anniversarium solemnissime celebretur in d. Ecclesia pro salute anime sue....

DOCUMENT 1430b

1430 **After January 21 (new style).** ***Ricordo*** **confirming the augmentation of Giovanni de' Medici's endowment by 800 florins.** [*Biblioteca Medicea Laurenziana*, Florence, *ASL 2866, Filza di quaderni di Ricordi, 1389–1533, c.2r*, from *Donatello e la Sagrestia Vecchia*, 1986, p. 102.]

Discussion: See Docs. 1428b, 1428c, 1430a.

...f[iorini] 800 di monte p[er] la festa di S. Cosimo e di S. Giovanni. Richordo come nel 1429 Cosimo e Lorenzo de medici donar[ono] al cap[ito]lo f[iorini] 800 mo[n]te

di cinque interi co[n] obligo d-una festa di s. cosimo e damiano e di s. giovanni evangelista e ogni lunedì uno off[izio] p[er] l-ani[m]a di d[ic]to giovanni loro padre. Carta p[er] mano di m. fra[nces]co di m. tommaso masi.

DOCUMENT 1431

1431 **No day or month indicated. Reference to an *istrumento* recording the construction of an altar in a new chapel to be built in the north side of the nave, on the site of the old basilica of San Lorenzo, near the old campanile.** [Cianfogni, 1804, p. 195. Documentary citation not provided.]

Discussion: In this partial quotation from and commentary on a church document of 1431, Cianfogni concludes that the old basilica was still been standing. The reference to "S. Lorenzo alto" may indeed be a reference to the then newly-constructed portion of the present basilica that stood behind the old basilica, before the latter was demolished. Since the floor of the new basilica is higher than that of the old basilica, it is possible that the new basilica was referred to by contemporary observers as "S. Lorenzo alto," to distinguish it from the lower old basilica that stood next to it for a period of time before being demolished. The term "S. Lorenzo alto" could also be a reference to an altar, however. In any case, the document indicates that in 1431 the old campanile was still standing.

"In un nostro istrumento dell'istituzione d'una Cappella ordinate l'anno 1431. da Don Tommaso Spigliati Monaco della Badia Firoentina vi si legge, che gli è assegnato dal Capitolo nella Chiesa il luogo per fabbricarvi un'Altare, *o dove è quello di S. Lorenzo alto; o trà questo, e quello di S. Giorgio, che è presso il campanile*;con patto, che fabbricandosi nella Chiesa (s'intende della nuova fabbrica, a cui avea già dato principio Giovanni de'Medici) Cappelle ordinate, e uniformi, il Capitolo non possa impedirlo. La Chiesa vecchia dunque co'suoi Altari era allora in piedi, e in stato da potervisene erigere un nuovo."

DOCUMENT 1433a

1433 **May 23. Prior Matteo Schiattesi allocates the transept chapel adjacent to the northern side door to Luca di Marco di Jacopo di Bartolo.** [*ASF Notarile C.475, ser Bartolomeo di Bambo Ciai* (1430-7) fos. 91v-92r, May 23, 1433, from Elam, 1992, p. 167, n. 46.]

Discussion (a): With this allocation, made during the construction hiatus of 1425-1442, the eighth and last private transept chapel finally receives a patron, nearly ten years after the seventh was allocated to the Rondinelli in July 1423 (see Doc. 1423d), and also nearly ten years after Prior Matteo Schiattesi is granted the right to allocate the chapel (see Doc. 1423e).

Discussion (b): With regard to the document quoted below, Elam writes: "I have not been able to trace the Act of 1423 to which Ciai refers. In 1433 Luca di Marco's obligations to the chapel were recorded in his tax returns. He had endowed the construction and officiation of the chapel with 1,000 florins invested in the Monte Commune (Catasto 469, fos. 469, 437^r-440^v) and owed Benedetto Schiattesi 34 florins for the remainder of its purchase price ('O a dare a messer Benedetto priore di San Lorenzo per resto duno principio d'una chappella comprata da lui fl. trenta quattro'). The same year he was elected an *operaio* of the church (ASF Signori Deliberazioni Ordinaria Autorità 41, fo. 14v.)"

Venerabilis Religiosus Dominus Benedictus quondam Mattei de Schiattesibus vigore commissionis eidem de mense septembris anni domini MCCCCXXIII per eos tunc socios operarios opere Sancti Laurentii de Florentia de nominando quem voluerit in *dominium capelle fiende prope nolarium dicte ecclesie et prope cappellam fiendam per heredes Zanobi ser Gini, ut constat de commissione manu mei notarii publici infrascripti, nominavit et recognovit in dominium et seu factorem dicte cappelle, cum honeribus alias deliberatis olim cappellis perfixis, Lucam Marci Jacobi Bartoli promictentem omnia facere quae et cumque teneatur secundum deliberationem circa dominationem dictarum cappellarum mea manu scripta.*

DOCUMENT 1434a

1434 **March 16 (new style). Decree issued by the *signoria* ordering that a block of buildings adjacent to the basilica of San Lorenzo be demolished.** [*A.S.F. "Signori e Collegi, Deliberazione, Ordinaria Autorità" Reg. 34* (16 e 18 marzo 1433[34]), from Roselli and Superchi, 1980, pp. 50–53.]

Discussion: The demolition presumably enlarged the existing piazza in front of the old basilica of San Lorenzo, and created the present Piazza San Lorenzo. Similar to prior Dolfini's petition of 1418 (Doc. 1418a), this decree justifies the demolition by noting that the properties to be demolished are occupied by "dishonest persons" (*persone inhoneste*). The demolition is to be carried out by the *opera* of Santa Maria del Fiore, of which Brunelleschi is *capomaestro*.

> *Attendentes omni ingenio ad ornatum, et magnificentiam Civitatis, viso quod Ecclesia B Laurentii in structura, et ornamentis ampliatur, et quod propterea foret decentius plateam hujusmodi Ecclesiae ampliari, intellecto maxime, quod infrascriptis domibus, ut plurimum, retinentur persone inhoneste, et non convenientes in eodem loco, volentes providere deliberaverunt, quod omnes, et singule domus, apothece, et hedificia quesumque, que sunt super dicta platea contra domus illorum della Stupha, videlicet inter plateam, et dictam domum existentes ab apotheca, in qua exercetur per Giuseffum aromatarium ars aromatarii, que in strata recta, per quam itur recto tramite* al Canto alla Macine *circum circa, ut tenent, destruantur, et eiiciantur in terram* (Moreni, *Continuazione*, vol. 1, p. 2 note 4).

See discussion in: Hyman, 1975, pp. 107–108, and transcription of second half of Moreni passage on p. 107:

> "The area to be levelled was specified in the decree; it ran from the palace of the della Stufa family on Via della Stufa, opposite the last portal of the old church ('*contra ultimam portam dicte ecclesie*' [but these words are not included in the transcription below]), to the shop of spice dealer Giusaffà in Via de' Ginori—in modern terms roughly the area north of the church occupied by the present Piazza S. Lorenzo ('*omnes et singule domus, apotece et hedifitia quecunque et cuiscunque sint; que sunt super dicta platea contra domus illorum della stufa, videlicet interplateam et dictam domum existentem ab apoteca in qua exercetur per Giusaffam aromatarium ars aromatarii, que est in strata recta per quam iter recto tramite al canto alla macina, usque ad viam que est contra viam que dicitur la via della stufa circhuncircha ut tenent distruantur et licinatur in terram*')."

DOCUMENT 1434b

1434 **April 30. Letter from fourteen-year-old Ugo di Lorenzo della Stufa to Cosimo's son, Giovanni, noting that a new piazza has been created in front of the basilica of San Lorenzo.** [*Biblioteca Nazionale Firenze, Conv., Sopp. c. 4. 895, fol. 131r,* from Hyman, 1975, p. 108, n. 61.]

Discussion: See Document 37

Credo ai sentito chome Loteri[n]gho nostro è stato de' singniori e le chase che ci erono diri[n]petto sono ito a ter[r]a che abiano testè una bel[l]a pi[az]za dinanzi al'uscio siche vedi chome le cose vano....rachomandami a chosimo e a lorenzo e a mona chontesina e a laltra brighata.

DOCUMENT 1434c

1434 **June 3. Church document recording the approval by the prior and canons of San Lorenzo of a detailed proposal by a group of citizens to build nave chapels, once construction of the nave commences.** [Florence, *Archivio di Stato, Notarile anticosimiano, M 273, insert I, f. 321v*, from Ruda, 1978, pp. 358-361.]

Discussion: With Cosimo de' Medici in exile, a group of citizens apparently attempt to reassert control over the basilica of San Lorenzo (see Saalman, 1978, pp. 361-364). The proposed new chapels contain many similarities with the design of the present nave chapels, most notably the greatly reduced height and depth dimensions compared with the transept chapels.

In Christi nomine amen. Anno ab eius salutifera incarnatione MCCCCXXXIIII, indictione XII, die III mensis Iunii. Actum Florentie, in populo S Laurentii et in sacristia ecclesie S Laurentii predicti, loco capituli dicte ecclesie, presentibus testibus agnolo Iacobi Christofari de Castro Franco vallis superioris et Antonio Palmieri de Fornace de partibus Casentini, clericis dicte ecclesie etc.

Cum, ut asseruerunt infrascripti dominus prior et canonici dicte ecclesie S Laurentii, certi homines et persone, devoti dicte ecclesie, habeant curam et affectionem ipsi ecclesie et dicant se velle temporibus futuris edificare et seu hedificare facere in dicta ecclesia capellas ut in ipsis celebrentur divina offitia, que sint conformes aliis capellis iam inceptis et in futurum edificandis in dicta ecclesia. Et volentes dicti infrascripti dominis prior et canonici providere circa hedificationem dictarum capellarum hedificandarum adeo quod bene et honorabiliter respondant hedificio incepto in dicta ecclesia. Et habita [sic: habito] *per eos, ut dixerunt, colloquio tractatu et consilio cum pluribus ydoneis et intelligentibus magistris, et inter eos deliberatione solempni, omni modo etc. providerunt ordinaverunt et deliberaverunt quod capelle deinceps fiende et hedificande in dicta ecclesia fiant et hedificentur modo et forma ac ordine infrascriptus videlicet.*

Quod omnes ipse capelle et quelibet ipsarum sint longitudinis brachiorum decem et octav partis alterius brachii et non ultra, nec minores, et quod ex ultraque parte dictarum capellarum fiat et fieri debeat unus pilastrus lapide macingni concii secundum formam et qualitatem aliorum pilastrorum positorum et hedificatorum ex latere superiori in aliis capellis dicte ecclesie, latitudinis brachiorum unius cum dimidii. Qui pilastrus sit et esse debeat in ecclesia et extra muram dicte ecclesie cum ipso tamen muro coniunctus per quartam partem brachii, cum basis et capitellis iusta formam predictam et etiam eiusdem altitudinis et maneriei. Super quibus pilastris fiant et fieri debeant architrave, fregium et cornice [sic] secundum formam predictam, videlicet aliarum capellarum dicte ecclesie iam hedificatarum et seu inceptarum hedificari. Super qua cornice cuiuslibet capelle ex predictis capellis hedificandis fiat et fieri debeat unus oculus com conciis modo et forma et prout et sicut sunt oculi capelle Iohannis de Medicis et eiusdem qualitatis, altitudinis et forme. Super quo oculo etiam fiat et ordinetur una ghiera concii lapidum in archis, conrespondens volte fiende super navi dicte ecclesie. Et quod inter dictos pilastros fiat et hedificetur una tribuna in omni et qualibet et super // omni et qualibet huiusmodi capellarum predictarum hedificandarum, latitudinis brachiorum VII, que tribuna sit et esse debeat longitudinis brachiorum trium cum dimidio et altitudinis usque ad summitatem capitellorum dictorum pilastrorum. Ac etiam fiant et fieri debeant super angulis dicte tribune ornamenta lapidea concii ad similitudinem tribunarum que sunt in capella nove sacristie dicte ecclesie. Et quod in dictis huiusmodi capellis et qualibet earum fiant et fieri debeant tres gradi lapidei, duo videlicet extensi et unus qui circueat per dictam

tribunam. Ac etiam fiat in eis et earum tribunis unum altare pro qualibet, lapiden [sic] macigni, super quinque culunnis [sic], cum tabula quadrata et sine civoriis, picta honorabiliter. Et quod in dictis huiusmodi capellis et seu tribunis non possit fieri aliqua pictura preter tabulam predictam sine expressa licentia capituli dicte ecclesie. In quo oculu de quo supra dictum est, fiat et fieri debeat oculus vitreus et seu apponi vitreus honorabiliter. Et quod muri dictarum tribunarum et seu capellarum ex latere exteriori dicte ecclesie et seu dictarum capellarum fiant et sint recti et cum basis ex parte inferiori et cornicibus ex parte superiori, in modum et secundum formam aliorum murorum factorum in dictis aliis capellis inceptis hedificari. Et fiant et construantur lapidibus de cava et seu lapidibus illius qualitatis de quibus constru[c]ti sunt alii muri exteriores aliarum capellarum predictarum et similes altitudinis.
Nomina vero sunt hec, videlicet:
dominus prior prefatus
presbiter Nerius Andree
dominus Baldasar magistri Antonii
dominus Bartholomeus Andree
dominus Iohannes de Spinellinis
dominus Bernardus Iohannis
dominus Antonius de Aleis
dominus Laurentius Laurentii de Pisis.

DOCUMENT 1440a

1440 **June 11. The cupola and campanile of the Cathedral of Florence are illuminated to celebrate the victory of Florence over the armies of Duke Filippo Maria of Milan at the Battle of Anghiari.** [Archives of the *opera* of Santa Maria del Fiore, II, 4, 14, c. 77, as quoted verbatim, with commentary, by Saalman, 1980, p. 279, Document 303.]

Discussion: The military victory combined with the spectacle of the illuminated cupola perhaps signalled a period of renewed civic pride and optimism in Florence (see Saalman, 1993, p. 158).

"Victory at Anghiari–brands on cupola and campanile 'per la novita della vittoria del ducha.'"

DOCUMENT 1440b

1440 **September 24: Description of the funeral of Lorenzo de' Medici, brother of Cosimo de' Medici, held in the old basilica of San Lorenzo.** [Moreni, I, 1816, pp. 41–43, from various sources, as noted.]

Discussion: The standards of the *comune* and all the guilds were on display, and Bishop di Valvi sang mass. In addition, Pope Eugenio IV, who was headquartered in Florence at the time, sent both his standard and that of the Church of Rome, nine of his cardinals, an unspecified number of other church representatives, and one hundred torch bearers. Evidently the pope himself did not attend. The lavish ceremony probably brought as much embarrassment to the church as honor, for behind the cramped old basilica, into which so many dignitaries and so much display had to be accomodated, lay the modern ruins of the much larger new basilica, begun two decades earlier but abandonned soon thereafter. With Lorenzo's death, Cosimo became the sole remaining heir to Giovanni "di Bicci" de' Medici.

"La morte di Lorenzo di Giovanni Bicci de' Medici, da cui discese la linea dei Granduchi Medicei, fratello di Cosimo P. P., avvenuta ai 23. Settembre dell' anno 1440. fu di non lieve dolore al nostro Capitolo, il quale lo si riputava a tutta equità uno dei suoi più grandi benefattori. Le solenni Esequie fattegli in Chiesa nostra così le ci vengono descritte dall' Ammirato [S. Ammirato, *L'Istorie Fiorentine*, Florence, 1647] nella *Part. II*. della sua Istoria fiorentina a *pag*. 32[:] 'Era egli uomo per le sue molte buone qualità grandemente caro ai cittadini. Gli onori fatti al suo corpo avanzarono di gran lunga la fortuna di un privato cittadino, il che fa non piccola testimonianza della potenza di quella casa; conciosiachè non solamente egli fusse onorato dalle bandiere del Popolo, della parte Guelfa, della Mercatanzia, delle Capitudini, e degli altri Corpi de' Magistrati della città, ma hebbela ancora dal Pontefice Eugenio (IV), da cui fu spezialmente amato, e havuto caro. Lodollo pubblicamente il Poggio, da colui, il quale scrisse l'Istorie, e fu accompagnato alla sepoltura dai Nepoti del Papa, e da tutti gli Ambasciadori, i quali erano nella Città.' Il Cambi [Cambi, Cronica Fiorentina,] soggiunge nella sua Cronica Fiorentina: 'il Papa vi mandò tutti i Cardinali, e Prelati della Corte.' Difatti nel libro XXX. de' Sagrestani *pag*. 30. si legge questo Ricordo. 'A dì 25. Settembre sotterrammo Lorenzo di Giovanni de' Medici in domenica; cantò la messa il Vescovo di Valvi, e in coro nostro furono nove Cardinali, e Papa Eugenio (che allora risedeva in Firenze) gli mandò lo stendardo, o vero Bandiera della Chiesa, et la sua, e cento torchi, avvegna gli riportassino; fu molto onorato dalla Comunità, largimogli tutto l'ornamento della bara, e per questo avemmo dalla donna sua (Ginevra Cavalcanti) una Pianeta di domaschino bianco.' Vi è ancora chi dice, e tra questi Giovanni di Pietro Buondelmonti nel famoso suo Priorista Ms. originale presso di noi in foglio atlantico, che l'istesso Sommo Pontefice e' v' intervenisse: ecco le sue parole stesse. 'A tempo di questi Priori morì Lorenzo di Gio. Bicci de' Medici, il corpo del quale fu molto onorato di cera, e di bandiere, et all' esequie sue andò Papa Eugenio con tutti li Cardinali, che allora erano in Firenze:' ma il silenzio delle nostre memorie ci fa temere, anzi che no, della verità di tale asserzione."

DOCUMENT 1440c

1440 **November 20: Deliberation of the *gonfalone del Leon d'Oro* offering the rights of patronage to the high altar chapel of the basilica of San Lorenzo to anyone willing to undertake its completion.** [*Archivio di Stato di Firenze, Protocollo di Ser Angiolo di Cinozzo Cini, C. 525, 1437–1455, c. 60ff*, from Ginori Conti, 1940, pp. 236–240.]

Discussion: The once-feared Medici takeover of the church (see Doc. 1434cc) is apparently now accepted as inevitable by the citizens of the *gonfalon*. This deliberation, the product of a meeting of the *gonfalon* council called by prior Schiattesi in the Old Sacristy, appears to be but a thinly-veiled offer to Cosimo de' Medici, the only individual in the city who would have been willing and financially able to undertake construction of the high altar chapel. The prior and *gonfalon* apparently believed that only through the involvement of Cosimo as a major patron would the church construction, suspended since about 1425 (see below and Doc. 1425a) ever resume. The delay, the document notes, caused the incomplete work to deteriorate, and was a sourrce of "humiliation and shame for the entire parish (*vilipendium, et ignominiam totius dicti populi*). The document indicates that construction of the basilica began in 1419, a claim that cannot be verified (see Doc. 1421a), and that it came to a halt in about 1425 (*anni quindecim, vel circa*) due to the pressure of war taxations levied not only on laymen but on the prior and canons of the church as well (*non solum per cives seculares*…).

Cum hoc sit, ut infrasciptus dominus prior asseruit, quod de anno 1419, vel circa, tempore recolende memorie domini Mattei Dolfini, tunc prioris ecclesie, et celeberrimi templi S. Laurentii predicti, et infrascripti domini Benedicti nunc prioris, et tunc canonici dicte ecclesie et templi fuisset incepta fundari cappella major ecclesie, et templi predicti pro ampliando dictam Ecclesiam, et templum secundum convenientiam ejusdem, considerato ipsum templum antiquitus, ut dicitur, fuisse majus dicte civitatis, et multo populo, atque notabili semper usque in holiernam diem abundantius, et canonicorum collegio, ac multis aliis clericis decoratum; et insuper in eodem multo tempore vixisse, et obiisse, et per plures annos sepultum jacuisse eximium Zenobium sanctissimum episcopum civitatis predicte, et sepissime secum ibidem ecclesie *doctorem Ambrosium in maxima devotione, et caritate stetisse, et dictum templum, et ecclesiam in sui memoria trium corporum Sanctorum, videlicet, S. Marci Pape, S. Concordie martiris, atque S. Amati abbatis dotasse, sicuti hodie in dicto templo, et ecclesia clare constat; et cum hoc sit, quod post mortem dicti domini Mattei dictus venerabilis vir dominus Benedictus olim Mattei de Schiattensibus prior dicte ecclesie et celeberrimi templi supradicti semper desideraverit, et hodie desideret dictam cappellam perfici, dictamque ecclesiam, et templum in omnibus extollere, erigere, et ampliare, et nunquam potuerit, nec futuris annis vite sue speret posse propter assiduas ghuerras, et cotidianas solutiones factas, et que cotidie fiunt, non solum per cives seculares, verum etiam per dictum dominum Priorem, et ejusdem Ecclesie canonicos; et cum hoc sit, quod jam sint anni quindecim, vel circa, quod in dicta majori cappella non fuerit aliquid edificatum, sed sit, et fuerit talis cappella, et tale opus propter necessitatem pecunie penitus derelictum; et cum ex predictis, non solum edificio dicte majoris cappelle, ut dictum est, incepte, verum etiam dicte sacrestie et cappelle celeberrime jam fere prefecte per famosissimum virum Joannem Adovardi de Medicis, et Cosmam, et Laurentium eiusdem Ioannis prestantissimos filios, et aliis cappellis jam inceptis, et non perfectis per particulares cives, et populares ecclesie dicti S. Laurentii ex utraque parte dicte majoris cappelle detrimentum, imperfectio, et retardatio sequatur, et resultet in vilipendium, et ignominiam totius dicti populi, idcirco infrascripti venerabiles, egregii, et prudentes viri Bartholomeus olim Cinozi Ioannis Cini, vexillifer dicti Vexilli Leonis ad aurum, magister Bartholomeus Cambi et medicine doctor, dominus Dominicus Niccolai de Martellis legum Doctor, Cambinus Niccolai Francisci capitaneus Partis Guelforum, Antonius ser Ludovici della Chasa, Panutius Zenobii del Bua de officio Otto Custodie dicte Civitatis, Franciscus magistri Antonii magistri Guccii de dicto officio Otto, Simon Francisci de Ginori de officio Sex Mercantie, Laurentius Andree domini Ughonis della Stufa, Ser Franciscus ser Tomasii Masii, Andreas Raynaldi de Rondinellis, Federigus Niccolai Ghori Ghori, Iacobus Georgii Aldobrandini del Nero, ser Albertus ser Tomasii Masi, Iacobus Thomasii Tani, Michael Francisci ser Santi Bruni, Mariottus Ioannis dello Steccuto, Andreas Sinibaldi de Sommaria, Niccholaus Blasii ser Nelli, Andreas Francisci Cambini, Franciscus Petri de Ginoris, Andreas Iohannis della Stufa, Dominicus Iuliani de Ginoris, Franciscus Iacobi de Guasconibus, Dominicus Laurentii de Attavantibus, Iohannes Nuti Bartoli, Zenobius Petri de Marignollis, Iohannes Iohannis de Ghoris, Iacobus Thommasii de Schiattensibus, Antonius Veneris Cini aurifex, Vettorius Nelli Bartholomei Nelli, Antonius Marci Sostegni, Marcus Bartholomei aurifex, Manettus Masini forzerinaius, Antonius ser Iohannis Bonajuti, Franciscus Neronis Nisii Neronis, Bernardus Iacobi ser Francisci [Ciai], Andreas Lancillotti de Lutiano, Niccholaus Francisci Cambini, Niccholaus Zenobii Bonvanni, Niccholaus Zenobi Benintendi, Iohannes Luce de Maccianghinis, Nerius Leonardi Grilli, Bartolomeus basterius, Filippus Bartholomei del Grigia, Iohannes magistri Antonii della Scarperia, Matteus Antonii aurifex, Iacobus Antonii Veneri aurifex, Antonius Neronis Nigii Neronis, Bartolomeus Lotti Albizi, Franciscus Niccholai Cambini, Nigius Neronis Nigii Neronis, Laurentius Iohannis della Stufa, Franciscus Baldini Iohannes Inghirami, Iacobus Gheri della Ressa Spetiarius, ser Iacobus ser Filippi de Lutiano, Iohannes ser Ludovici della Casa, Zenobius Iacobi de Bucherellis, Nellus Nelli Bartholomei ser Nelli, Zenobius Thommasii de Ginoris, Filippus Simonis Banchi, ser Lottus ser Francisci ser Thommasii, omnes cives Florentini, et de populo dicte ecclesie, et templi S. Laurentii, nec non de dicto Vexillo Leonis ad Aurum, convocati, et insimul congregati in suprascripta cappella, et seu sacrestia jam fere perfecta per dictum Iohannem de Medicis, et Cosmam, et Laurentium eius filios, more solito per nuntii requisitionem de mandato, et ad requisitionem suprascripti Bartholomei Cinozzi Vexilliferi predicti, et ad petitionem, et instantiam supradicti domini Benedicti, et suorum canonicorum, nec non etiam Operariorum nunc denuo constitutorum per Dominos Priores Artium, et Vexilliferum Iustitiae Populi, et Communis predicti, et eorum Collegia pro perfectione operum inceptorum in dicta ecclesia, et templo S. Laurentii, audito primo super predictis, et infrascriptis dicto venerabili viro domino Benedicto priore suprascripto, in effectu, suo nomine, et suorum canonicorum proponente, et narrante coram supradictis Civibus, et popularibus predictis omnia supra narrata, et dictam majorem cappellam,* *ut supra dicitur, edificari inceptam, propter necessitatem dicti Prioris, et eius Capituli non posse perfici, ex quo sequebatur detrimentum, et imperfectio, et retardatio omnium aliarum cappellarum, et omnium operum inceptorum per particulares cives in dicta ecclesia in maximum dedecus, et vilipendium dictorum prioris, et canonicorum, et totius universitatis dicti populi, et hominum, et personarum dicti Vexilli; et demum requirente, et hortante dictos cives populares suos, ut eisdem placeret, dictam Cappellam sumptibus totius universitatis dicti populi perficere, et eidem perfectum finem imponere, et super predictis, et infrascriptis consulere, providere, et deliberare, prout eisdem videretur pro perfectione dicte cappelle, et offerente se, et ejus canonicos potius velle dare, et concedere dictam majorem cappellam inceptam ad eam edificandam, et finiendam illi, vel illis, cui, vel quibus dictis suprascriptis hominibus, et popularibus suis placeret, et eisdem videretur, seu illi, vel illis, quem, vel quos dicti suprascripti homines, et populares sui eligerent, et nominarent. Auditis igitur primo omnibus suprascriptis per dictum dominum Priorem expositis, et narratis, et habitis super his, et infrascriptis plena, et matura deliberatione, et quolibet dictorum civium super predictis consulente, proponente, et arrengante, demum post multos ad invicem habitos tractatus et deliberationes inter ipsos omnes unanimes, et concordes, et nemine ipsorum discrepante, ipse Bartholomeus Vexillifer predictus, una cum suprascriptis hominibus, et personis, et dicti suprascripti homines, et populares vice, et nomine totius universitatis dicti Populi, omni modo, via, jure, et forma, quo qua, et quibus magis, et melius potuerunt, consulerunt, proviserunt, et deliberaverunt, quod quilibet civis, unus, seu plures dicti Populi S. Laurentii possint, eisque liceat in dicta majori cappella, et super quibuscumque muris dicte majoris cappelle edificare, et edificari facere, et eam prosequi, et finire eo modo, et forma, prout, et sicut huiusmodi tali civi edificari volenti videbitur, et placebit. Et insuper eligerunt, fecerunt, creaverunt, et deputaverunt eorum, et eorum successorum, et hominum ipsorum dicti populi, et totius universitatis dicti populi sindicos, procuratores, commissarios, actores, factores, et certos nuntios speciales venerabilem virum dominum Benedictum priorem predictum, et prudentes, et discretos viros Niccholaum Francisci Cambini, Andream Lancilotti de Lutiano, Bernardum Iacobi ser Francisci Ciai, Franciscum Neronis Nisii, et Niccholaum Zenobii Bonvannis cives Florentinos dicti Populi Sancti Laurentii, nec non etiam dicti, et de dicto Vexillo Leonis ad aurum ad presens Operarios dicte Ecclesie, una cum suprascripto domino Benedicto, constitutos per dominos Priores predictos, et eorum Collegia, et duas partes ipsorum in concordia, aliis etiam absentibus, et contradicentibus, specialiter, et nominatim ad querendum, inquirendum, perquirendum, et investigandum de uno, seu pluribus hominibus, et personis dicti populi tantum, et non alterius populi ydoneis, et sufficientibus ad dictam cappellam perficiendam, et finiendam, et dictos tales huiusmodi cives unum, et seu plures, prout dictis operariis, et duabus partibus ipsorum videbitur convenire, requirendum, hortandum, rogandum, orandum, et supplicandum, ut eisdem, et seu eidem placeat dictum pulcherrimum opus, jam pro derelicto habitum, hoc est dictam majorem cappellam cum suis edificiis eidem majori cappelle pertinentibus, et ab eadem dependentibus, perficere, finire, et eidem perfectum finem imponere eo modo, et forma, prout constat, et quemadmodum dicto tali huiusmodi civi uni, seu pluribus videbitur convenire, et ad ringratiandum, et gratias habendum huiusmodi tali civi uni, seu pluribus tale opus perfici volentibus, et dictos constituentes, et universitatem, et populum predictum offerendum ad mandatum et beneplacita talis, et seu talium huiusmodi civium, prout dictis Operariis, et duabus partibus eorum, ut supra videbitur, et generaliter dantes etc. promictentes etc. rogantes etc.*

DOCUMENT 1441

1441 **Cosimo begins quarrying work for San Lorenzo.** Hyman, diss., pp. 305 and 431

DOCUMENT 1442a

1442 **No month provided. Record of a contribution to the church of San Lorenzo pursuant to construction of the Cappella Luca di Marco, which the document notes had already begun.** [*ASF, Catasto, 623, Portate of Marco and Giovanni di Luca di Marco di Jacopo Bartoli*, c. 390r, from Pacciani, p. 97, Doc. 34.]

Denari di Monte (...)
f. M, cioè f. mille di presentazioni sotto nome di Lucha di Marcho, i quali denari sono con condizione che non si possono promutare e che l-le paghe d'essi possi pigliare li operai di San Lorenzo insieme con priore e convertirle in muramento d'una chappella principiata nella detta chiesa di San Lorenzo, e conpiuta di murare si convertano in fare uficiare detta chappella, come tutto apariscie distesamente per libri del Monte, f. 32 s.10.

DOCUMENT 1442b

1442 **March 24 (new style). Entry in a San Lorenzo construction ledger maintained for Cosimo de' Medici by Bartolommeo di Tommaso Sassetti recording initial payment by Cosimo to fund commencement of quarrying at Trassinaia.** [*Archivio del Capitolo di S. Lorenzo, Ms. A3, "Entrata e Uscita delle Spese fatte dal Cosimo de Medici per la Muraglia Nuova dell'Anno 1441 al 1452 tenuta per Bartolommeo di Tommaso Sassetti,"* in: Hyman, 1968, pp. 431 and 524, as noted below.]

Discussion: Seventeen months after the *gonfalon* issues its resolution offering the rights of patronage of the high altar chapel of San Lorenzo to anyone willing to undertake its construction (Doc. 1440c), Cosimo recommences construction activity at the church. Cosimo transfers 496 *lire*, 15 *soldi*, 8 *denari* from his private account (*a sua ragione propria*) to the account of the Florence branch of the Medici bank, for the purpose of "...uncovering the *macigno* quarry in Trassinaia, and for quarrying stone and hauling the first load to San Lorenzo..." (*...per fare scoprire la chava del macigno di trassinaia e per fare a bozare pietre a conducierne 1ª parte di San lorenzo...*). Evidently he has not yet decided how to fund the project in the long term, and he refrains from making his arrangement with the church and *gonfalon* public just yet. (See discussion in Hyman, 1968, p. 305f; and Hyman, 1975, p. 98ff.)

> *Cosimo de medici proprio de avere a di 24 marzo 1441 L. cccc_lxxxx_vi s.15 d.8 sono per F [fiorino largo] 116 s.8 d.6 affiorino che il bancho di firenze avea a debitore il detto cosimo proprio alq_ di cassa s [segno] D.145 per più spese fatte in nel detto an[n]o in nellavorio di San Lorenzo posto spese debino dare in questo 3 I quali il detto cosimo proprio pagho al detto bancho faccendoli tirare a sua ragione propria ______ L.496.15.8* (Hyman, 1968, p. 524)

> *Spese fatte in nelavorio della muraglia della chiesa di San lorenzo in cominciando lan[n]o presente 1441 deono dare a di 24 di marzo 1441 L. cccclxxxxvi s.xv d.viii chettanto s' èi spesò Som[m]a nel detto an[n]o per fare scoprire la chava del macigno di trassinaia e per fare a bozare pietre a conducierne 1ª parte di San lorenzo come tutto a pare al q[uadern]o delcassa del banco [segno] d 145 dove il detto ba[n]cho avea a debitore Cosimo proprio fe buoni al detto bancho. E per nelo faciamo creditore in questo 2 ______ L. 496.15.8* (Hyman, 1968, p. 431)

DOCUMENT 1442c

1442 **May 17. Record of payment in the San Lorenzo ledger for two and a half cart loads of stone from a quarry in Trassinaia.** [Hyman, 1968, p. 431.]

Discussion: Approximately two months after Cosimo provides funding to commence quarrying operations at Trassinaia (Document 44), the first loads of stone are transported from the quarry to the San Lorenzo construction site.

> *Item deono dare a di 17 di maggio 1442 L.x demo a nan[n]1 do ghoro carradore per vettura di carrate 2 1/2 di pietre di macigno cireco da settignano dalla cava di trassinaia pagho B.S. in questo 4 ______L. 10*

DOCUMENT 1442d

1442 **July 7. Record of payment to *scarpellatore* Domenicho di Piero for unspecified work. Domenico, the document notes, "stays with filipo di Ser brunellesco."** [Hyman, 1975, p. 118, n. 59, brackets are Hyman's. Document reference is that same as that of Doc. 1442b.]

Discussion: On Domenico di Piero, Hyman notes: "An otherwise anonymous and apparently insignificant stonecarver, in the Ledger his name is [repeatedly—see Hyman, 1968, p. 384] followed by the phrase 'sta con Filippo di Ser Brunellescho.' A member of Brunelleschi's shop, he worked at S. Lorenzo for a little less than a year—from July 1442 through June 1443. No other information; his work likely on-site dressing and cutting of stones" (Hyman, 1975, p. 111). These apparently casual references to Brunelleschi, without prefatory title such as *maestro*, perhaps suggests that Brunelleschi was not serving as *capomaestro* of the San Lorenzo project at the time. The document furthemore confirms the historical inaccuracy of name "Brunelleschi," today used by convention (see Procacci, 1980).

> *Domenicho di piero scarpellatore che sta con filipo di Ser brunellescho de avere a di 7 di luglio* [1442] *opere 13 le quali a lavorato con noi…somma opere 192 montano per s.12 il di…*[fol. 13 right].

DOCUMENT 1442e

1442 **August 13. Notarial record of Ser Jacopo da Romena formally recording the concession of the rights of patronage of the high altar chapel, and all other parts of the church up to the point where the old basilica of San Lorenzo stands, excluding those chapels to be built by other private citizens, to Cosimo de' Medici, in exchange for Cosimo's commitment to build those portions of the church at his own expense within six years.** [*Archivio di Stato di Firenze, Protocollo di Ser Jacopo da Romena, I. 9 (1442–1443), ff. 40r–42v*, from Ginori Conti, 1940, pp. 240–245; for partial English translation, see Battisti, 1981, pp. 368–369.]

Discussion: Approximately one year, nine months after the *gonfalon* issued its resolution regarding the high altar chapel (Doc. 1440c), and approximately five months after Cosimo makes his first payment for construction of the church (Doc. 1442b), the terms of Cosimo's agreement with the chapter and *gonfalon* are are made public in a formal notarial record. The agreement is more far-reaching than the *gonfalon*'s offer of 1440. According to the agreement, Cosimo is to complete, within six years, not only the high altar chapel, but the transept, crossing, cupola, and the nave as far as the back of the old basilica (i.e., the entire trnasept and the first three bays of the nave). In exchange, he is granted the rights of patronage to the high altar chapel, and the right to place his coat-of-arms in the other parts. Perhaps based on either or both Docs. 1418a and 1440c, this document also notes that construction of the new basilica was commenced in about 1419 ("twenty-three years ago, or thereabouts"; *viginti tres anni vel circa*), but notes that it stalled a few years later (For additional discussion see: Hyman, 1968, pp. 305–306; Hyman, 1975, p. 98, n. 3; and Saalman, 1993, pp. 159–160).

In Dei nomine Amen. Anno Domini sue salutifere Nativitatis MCCCCXLII, Indictione V, die XIII mensis Augusti secundum morem florentium, pontificatus SS. in Christo patris domini, domini Eugenii divina providentia Pape IV Anno xii. Actum Florentie et in ecclesia Sancti Laurentii, et in Sacristia dicte Ecclesia, praesentibus testibus ad hec habitis vocatis, et rogatis nobilibus viris Ugolino olim Nicholai Ugolini Martelli, et Piero Andreae Guglielmini de Pazzis civibus florentinis, et Fede Iohannis Antonii dicti populi S. Laurentii, et aliis etc.

Pateat omnibus evidenter presentis publici instrumenti tenorem inspecturis, collegialiter convocatis omnibus et singulis priore, et canonicis parrocchialis et collegiate ecclesie Sancti Laurentii florentini in loco Capituli dicte ecclesie mandato venerabilis viri domini Benedicti Mattei Schiattensis prioris dicte ecclesie ad sonum campane, nuntiique requisitionem, pro infrascriptis, et dicte ecclesie utiliter agendis, ad quam quidem convocationem interfuerunt infrascripti, dominus Benedictus Matthei prior, et dominus Lucas Cini, dominus Iohannes Lapi, dominus Baldassar magistri Antonii, dominus Bartholomeus Andree, dominus Bernardus Iohannis, dominus Laurentius de Pisis, dominus Laurentius Silvestri, dominus Marianus Iohannes, dominus Iohannes Leonardi, dominus Dominicus de Marighis, canonici dicte parrocchialis ecclesie et collegiate S. Laurentii Florentie, insimul collegialiter congregati in loco Capituli dicte ecclesie, et ubi negotia, et tractatus dicte ecclesie, et capituli fieri consueverunt pro negotiis ipsorum et dicte ecclesie et Capituli utiliter peragendis. Asserentes se esse duas partes, et ultra, prioris, et canonicorum dicte ecclesie, et posse facere, et representare totum Capitulum dicte ecclesie, et in eis residere totam vim, et potestatem totius dicti Capituli. Attendentes quod iam sint viginti tres anni vel circa prefati prior, canonici, et Capitulum, et nonnulli homines, et circumspecti viri cives florentini parrochiani dicte ecclesie S. Laurentii, in aumentum divini cultus, et pro ipsorum et suarum animarum salute ad reverentiam Beati Laurentii Martiris construere inceperunt, et edificare novam ecclesiam S. Laurentii ex latere superiori, et maiorem capellam, et cum aliis capellis, sacristia, et aliis opportunis, cum opere non modicum sumptuoso, capellam maiorem, navemque in medio ecclesie existentem ipsi priori, et canonicis reservatam, et cuilibet ex dictis civibus construendam et edificandam portionem suam in aliis capellis assignando, et inter alios olim bone memorie Iohannis Biccii de Medicis sacristiam cum duabus inibi capellis construendam, et edificandam suis sumptibus, que sacristia, et capelle per dictum olim Iohannem fuerunt perfecte, et integrate complete ac competenter dotate, ut latius constat manu mei Iacobi notarii infrascripti de anno Domini 1428 et mensis Februarii, cappellamque maiorem et navem dicte ecclesie in medio existentem fere usque <u>ad altare maius antiquum</u> dicte ecclesie, in qua chorus dicte ecclesie est edificandus dictis priori, et canonicis assignatam et reservatam, propter guerras que hactenus viguerunt et ad tempus vigent in partibus Tusciae, introitus redditus et proventus ipsorum et dicte ecclesie et capituli in tantum fore et esse diminutos, quod, ne dum valeant construere et perficere, sed vix ipsorum vitam substentare posse, quod quidem non solum in ipsorum et dicti capituli et ecclesie et parochianorum ipsius, sed totius populi florentini redundat non in modicum detrimentum; desiderantes predictis obviare et predictam cappellam maiorem et navem predictam ad optatum desiderium, et in quantum eis possibile foret, ipsorum vite temporibus, dictam ecclesiam ad suam pervenire perfectionem, habitisque collucutionibus et ratiociniis, tam inter eos, quam cum pluribus et pluribus parrocchianis dicte ecclesie de modo et forma quibus ipsorum desiderata voluntas adimpleri posset, et demum congregatis ad eorum petitionem tunc Operariis et parochianis dicte ecclesie S. Laurentii in suprascripta sacristia, constructa et edificata per dominum olim Iohannem et nomine ipsius, predicta omnia et singula exposita per prefatum dominum priorem per se et vice et nomine dicti Capituli, ut supra predictis consulere et deliberare deberent quid in predictis eis fore videretur faciendum ne dicta ecclesia sic noviter edificata taliter inconstructa et imperfecta remaneret, et habitis pluribus collucutionibus et tractatibus inter eos supra predictis, tandem omnibus consideratis et examinatis, asserentes ipsos fore et esse tantis variis oneribus agravatos et vexatos, maxime Comunis existentibus, quod predictis constructioni et perfectioni vacare non possunt, deliberaverunt in predictis quod prefati prior et canonici providere deberent prout eis videretur melius faciendum pro *expeditione predicta. Qui prior et canonici perquirentes cum pluribus et pluribus ex parochianis dicte ecclesie, et neminem invenientes qui manus suas porrigere vellet adiutrices, unum solum et dumtaxat nobilem et circumspectum virum Cosimum olim dicte bone memorie Iohannis Biccii de Medicis, honorabilem civem et mercatorem florentinum, qui ob devotionem quam semper ipse et sui predecessores habuerunt et hodie habent ad dictam ecclesiam S. Laurentii, obtulit et offert, in tantum quantur dicta capella maior et navis in medio ecclesie existens usque <u>ad altare maius antiquum</u> sibi et suis filiis et successoribus consignetur cum omni edificio et construtione hucusque facta usque in dictum locum, de bonis sibi a Deo collatis construere et perficere totaliter in tempus et terminum sex annorum proxime futurorum omnibus suis sumptibus et expensis et cum armis et signis suis, dummodo in prefata capella et navi non possit vel valeat poni aliqua alia arma vel signa nec fieri aliqua sepultura, sed solum et dumtaxat per dictum Cosimum, dumtaxat exceptis quod fieri possint sepulture pro priore et canonicis et capellanis dicte ecclesie; et pro exequendis predictis se et suos eredes et bona omnia mobilia et immobilia obligare per publicum instrumentum de iure validum; supra predictis invicem incipientes iurisperitos conferre, consultare, et tractare prior cum canonicis et canonici cum priore insimul de predictis et circa predicta; et demum post multas et longas consultationes, colloquia et tractatus inter eos habitos, unanimiter et concorditer collegialiter et capitulariter, omni modo, via, iure et forma quo et quibus magis et melius potuerunt, deliberaverunt per melius et utilius ipsorum et dicte ecclesie et Capituli, et ut dicta ecclesia ipsorum vite temporibus perficiatur, quod dicta concessio dicte maioris capelle et navis in medio ecclesie consistentis usque <u>ad altare maius antiquum</u> eidem Cosimo et suis filiis et successoribus consignetur, modo et forma predictis, per ipsum construendam et edificandam modo et forma predicta; et tamen, ne videantur eorum et dicti capituli et ecclesie negotia inconsulte agere, deliberaverunt alia hora se ad Capitulum congregari et in eo deliberare consulere et tractare maturius, si bonum, et utile videatur predicta fieri pro Capitulo et ecclesia; de quibus rogaverunt me Iacobum predictum de predictis conficere instrumentum.*

Item postea, ex intervallo, dicto anno, Inditione et die et loco, et presentibus dictis testibus adhibitis et habitis, vocatis et rogatis etc. etc., convocatis ad Capitulum in suprascripto loco omnibus et singulis priore et canonicis suprascriptis parrochialis et secularis ecclesie S. Laurentii Florentie, ad sonum campane et nuntii requisitionem, pro suprascriptis et infrascriptis negotiis utiliter pertractandis, mandato suprascripti domini Benedicti, ut moris est, ob quam convocationem interfuerunt omnes et singuli suprascripti ac etiam dominus Marianus Iohannis.

Ipsis sic capitulariter congregatis idem dominus Benedictus prior iterum et de novo, plane et intelligibiliter et clare omnia et singula supradicta per eos narrata et deliberata dixit, proposuit et narravit et iterum ipsos canonicos secundo monuit, ut super ipsis invicem capitulariter consultare, conferre et tractare deberent, et demum deliberare si et quid eis viderítur pro eis et dicto capitulo et ecclesia melius et utilius faciendum, prefatique canonici, ut supra dicitur capitulariter congregati, auditis et plane intellectis omnibus et singulis supradictis, ceperunt super eis, una cum dicto priore, et ipse prior una cum eis, et omnes simul, colloqui, conferre et tractare invicem, locutiones habentes super materia prelibata, unanimiter et concorditer, ipsorum nemine discrepante, collegialiter et capitulariter, omni via, iure et forma, quo et quibus magis et melius potuerunt, deliberaverunt predicta omnia et singula per dictos dominum priorem et canonicos provisa, exposita, dicta et narrata per ipsos priorem et canonicos utilius consulta fore pro eis et dicta ecclesia et Capitulo utilia, et demum concessionem dicte maioris capelle et navis faciendam dicto Cosimo Iohannis de Medicis, modo et forma predictis per dictum dominum priorem et canonicos, rationibus et causis alias dictis et allegatis in supradictis proximis tractatibus, fieri debere et facienda fore, et nihilominus ut sanius et consultius predicta fieri deberent, hodie alia hora deliberaverunt super predictis providere et deliberare velle quod ultilius videretur super predictis faciendum, monens iterum idem Prior dictos canonicos hodie alia vice ad capitulum congregari in suprascripto loco pro presentis negotii expeditione; de quibus omnibus rogaverunt me Iacobum de predictis predictum conficere instrumentum.

Item dictis anno, ind. et die et loco et presentibus dictis testibus adhibitis et habitis vocatis et rogatis etc. etc., convocatis etiam ad Capitulum in suprascripto loco priore et canonicis pro negotiis ipsorum et dicit capituli et ecclesie utiliter pertractandis, et ipsi sic capitulariter congregati iterum et iterum ceperunt super negotia superscripta tractare et conferre, et demum, post multas collocutiones et tractatus ad invicem habitos inter eos unanimiter et concorditer pro utilitate ipsorum et dicti Capituli et ecclesie, omni modo, via, iure et forma quo et quibus magis et melius potuerunt, deliberaverunt quod suprascripta concessio capelle maioris et navis, modo et forma predictis, fiat eidem Cosimo, pro se et suis filiis et descendentibus in perpetuum, per ipsum Cosimum infra dictum tempus et terminum sex annorum proxime futurorum construende et edificande; et volentes huiusmodi deliberationem et tractatus executioni debite demandare, sic capitulariter et collegialiter more solito congregati omni modo via iure et forma quo et quibus magis et melius potuerunt, fecerunt, constituerunt, convenerunt et ordinaverunt eorum et dicti templi et ecclesie verum et legiptimum sindicum, procuratorem et commissarium, actorem, factorem et certum nuntium specialem, et quidquid melius dici potest, venerabilem virum dictum Benedictum de Schiattensis priorem dicte ecclesie ad tractatus et deliberationem factam et habitam super dicta concessione maioris capelle et navis prenuntiandum et insinuandum reverendissimo in Christo patri et domino Bartolomeo de Zabarellis, Dei et Apostolice Sedis gratia archiepiscopo florentino, et seu eius in spiritualibus et temporalibus vicario generali et petendum et obtinendum licentiam huiusmodi concessionis dicte capelle maioris et navis, cum modo et forma predictis eidem Cosimo pro se et suis filiis et successoribus existentibus in perpetuum, per ipsum Cosimum, infra dictum tempus et terminum sex annorum, construende et perficiende, cum clausulis, capitulis, promissionibus, obligationibus, renuntiationibus et precepto guarentigie et aliis cautelis in similibus requisitis, ita quod de fine valeat et subsistat, et huiusmodi licentia obtenta, dictam concessionem dicte capelle majoris et navis in omnibus et per omnia, ut supra dictum, faciendam per probationem iustam de iure validam ad sensum et voluntatem dictorum Superiorum reverendissimorum Dominorum concessam, et generaliter ad omnia et singula alia faciendum, gerendum, procurandum et exercendum, que supra predictis et circa predicta et predictorum quodlibet, fuerint necessaria et opportuna, ut iuris ordo et facti qualitas predictorum postulant et requirunt, et que ipsimet constituere [et] facere possent si personaliter adessent.

DOCUMENT 1442f

1442 **August 13: *Ricordo* confirming the agreement, formally recorded in a notarial record of Ser Jacopo da Romena (Doc. 1442e), between the chapter of San Lorenzo and Cosimo de' Medici.** [*Rogiti di ser Iacopo di ser Antonio da Romena nell' ASF, Not. Prot. I, 9, cc.40 e sgg.*, from *Donatello e la Sagrestia Vecchia*, 1986, p. 103; for English translation, see Saalman, 1993, p. 159.]

Discussion: In addition to summarizing the terms of the agreement, the *ricordo* notes that the chapter had already built the walls of the high altar chapel to a height of eight *braccia*, presumably prior to 1425 (see Doc. 1425a).

A dì 13 d-agosto essendo ra[g]unato il priore co[n] canonici suoi Capitularmente in sagrestia dì di sancta Concordia, entrò drento a noi il nobile huomo Cosma di giovanni de medici e adomandò gli fosse concesso poter murare la Cappella maggiore la quale haveva già condotta il Cap[ito]lo a sua spese co[n] alcuno altro lascio fuor de fondamenti b[raccia] otto o circa et promesse infra anni sei perficere la Cappella detta et la cupola col coro, et a q[uest]o fare obligò se et i suoi heredi et beni et il cap[ito]lo molto humanamente gli concesse pregandolo dovessi accettare et di tutto fu rogato p[er] ro[gi]to di ser Antonio da Romena, il quale venne insieme allora in Capitolo con Cosma et menarono duo testimonj, ciò fu Piero d-Andrea de Pazzi et il fide Cozzone. No[n] molto in anzi a questo si ra[g]unò una gran parte di q[uest]o popolo, quasi tutti i capi principali et praticarono insieme alla nuova sagrestia che

dovessi p[er]ficere detta Cappella et veduto non potere per ["impotentia," crossed out] *levoronsi dalla impresa et allora il Cap[ito]lo concesse a Cosma.*
levato dal L[ibr]o della sag[resti]a di san L[oren]zo tenuto p[er] Giovanni di Lionardo sagrestano a c.67 nel 1442.

DOCUMENT 1442g

1442 **September 12. Cosimo transfers 40,000 florins to the Monte *Comune* in the name of the prior and chapter of San Lorenzo for a period of six years, on the condition that the interest on it be used for construction of the church.** [Hyman, 1968, p. 526.]

Discussion: Having commenced construction of the church slightly less than six months ago through the direct payment of approximately 500 *lire* in cash (Document 44), Cosimo now arranges more complex and long-term financing for the project. As explained by Hyman, he invests 40,000 florins in, or turns over holdings already invested in, the *Monte Comune* (the public debt) in the name of the prior and chapter of San Lorenzo, who were to receive, through the administering body of the *Banco Mediceo*, the annual interest on that sum. The interest was to be paid by the *Monte* at the prevailing rate, for six years (Also quoted in: Moreni, I, 1816, p. 8 n. 1; See discussion in: Hyman, 1968, pp. 305 ff, and Hyman, 1975, p. 98 n. 3).

Il banco nostro di Firenze de avere fino a di 12 di settenbre 1442 R [Fiorini] *cccc^{o}lxiii^{o} 1/2 di sugello I quali si paghorono a gli scrivani del mo[n]te per 1^{o} ghabella della condizione puo si cosimo a R* [Fiorini] *40M di mo*[n]*te* comune *che ssi permutarono in nel priore e capitolo e convento di San lorenzo co*[n] *condizione che lla rendita si abbia a spendere nella muraglia di San lorenzo per 6 an*[n]*i e conaltre cautele che in essa si contiene posti a spese in questo* 20 *ragionalli*____________*L.1974*

DOCUMENT 1442h

1442 **October 27. Record of payment for 13$^{3/4}$ bushels of lime to put in the foundations of the two freestanding crossing piers.** [Hyman, 1968, p. 435; for discussion see *ibid*., p. 320.]

Item a di 27 dottobre L. xlvi s.15 demo a giovan[n]i di franc_fornaciaio a Sa[n] nicholo per moggia 13 3/4 di calcina aute dalluj per L. 3 s.8 il moggia per mettere ne fondamenti de pilastri pagho B.S. in questo 18 ______*L. 46.15*

DOCUMENT 1442i

1442 **November 13. Record of payment for a load of chestnut logs to be used as piles for the foundations of the two freestanding crossing piers.** [Hyman, 1968, p. 436.]

Discussion: An excise tax (*ghabella*) of 10 *lire*, 3 *soldi*, 6 *denari* is paid on 12 carts containing 27 logs that arrived via the "porta alla Giustizia" (Hyman, 1968, p. 324).

Item fino a di 13 detto L. x s. iii d. vi paghamo a bartolomeo michelozi cam[erlengn]o alle porti per ghabella di 27 legni che ffurono 12 traini di castagnio dove avamo metti dentro alla porta alla Giustizia per metterli nei fondamento del pilastro....L.10.3.6

DOCUMENT 1442j

1442 **November 24. Two entries in the San Lorenzo ledger recording payment for excavation of the foundation holes for the two freestanding crossing piers.** [Hyman, 1968, p. 437.]

Discussion: The foundations are each to measure 5 braccia square and $9^{1/3}$ *braccia* deep, for a total of $466^{2/3}$ cubic *braccia* of foundation ($5 \times 5 \times 9^{1/3} = 233^{1/3}$; $233^{1/3} \times 2 = 466^{2/3}$). Of this total area, the chestnut piles are to occupy 12 cubic *braccia*. These foundations later proved to be inadequate for the load they were to carry, perhaps because the present crossing dome was made heavier than Brunelleschi intended (see Doc. 1457b), a circumstance than nearly led to the collapse of the crossing dome in the early eighteenth century (see Hyman, 1968, p. 320–322, and Ruschi in *San Lorenzo, 393-1993*, 1993, pp. 151-156).

> *Item deono dare a di 24 di novembre 1442 L. settanta posto piero di nenci chava i fondamenti debi avere in questo 19 per chavatura di [due] fondamenti dove fan[n]o a fare i pilastri della chiesa/ che ciascuno fu lungho bra. 5 e largho altrettanto e a dentro bra. 9 1/3 che in tutto furono tramendue bra. 466 2/3 quadre/ a rag_ di s. 3 il braccio______L. 70*

> *Item a di detto L. cinquantatre posto meo dantonio vocato ciancia renaiuolo debi avere in questo 24 sono per rienpitura di ghiaia di sopradetti fondamenti che furoni bra 466 2/3 per s. 2 d.4 il braccio/ mancho bra. 12 che inghonbrorono i pali______L. 53*

DOCUMENT 1442k

1442 **December 22. Record of payment to Giuliano di Nanni, *scarpellatore*, for 90 *braccia* of corner pilaster strips to be placed in the high altar chapel.** [Hyman, 1968, p. 439.]

Discussion: That the pilaster facings are already being ordered for the high altar chapel suggests that portions of the high altar chapel walls completed prior to 1425 are being incorporated into the new work (see Hyman, 1968, p. 326). By comparison, construction of the foundations for the freestanding crossing piers opposite the high altar chapel is only just getting underway (see Doc. 1442h).

> *Item a di dicenbre* [*sic*.] *1442 L. xxii posto giuliano di nan[n]i scarpellatore debi avere in questo 26 per braccia 90 di cantoni overo pilastrelli di pietra forte avemo dalluj per porre ne canti del muro della capella / a rag_ di s. 16 il braccio____L. 72*

DOCUMENT 1443a

1443 **No month provided. Description of a document that notes that the Chapel of della Stufa was built in 1443.** [*Entrata e uscita del Capitolo di S. Lorenzo* (1444-1445) N° 2430, described in Roselli and Superchi, 1980, p. 127.]

Discussion: The following words are those of Roselli and Superchi, who describe this document but do not quote from it.

> "Vi è annotato, tra gli altri un pagamento di Loteringo della Stufa per la sua cappella 'murata' nel 1443"

DOCUMENT 1443b

1443 **April 12. Two records of payment to master mason Marcho di Checho and his partner for construction of $14^{1/4}$ *braccia* of one of the freestanding crossing piers, at a rate of 21 *lire* per *braccio* of pier completed, and $30^{2/3}$ *braccia* of unspecified "cornices and architraves."** [Hyman, 1968, p. 447.]

Discussion: It may be noted that the amount listed in Roman numerals, 294 *lire* ("L. cclxxxxiiii"), does not correspond to the amount listed in Arabic numerals, 299 *lire*. Furthermore, since $14^{1/4}$ x 21 = 29.25, the correct amount owed would seem to be 299 *lire*, 5 *soldi*. According to Hyman, Marcho di Checho's partner was Chimenti di Nannozzo. (Hyman, 1968, pp. 323–324, and 389.)

Item a di 12 daprile L. cclxxxxiiii_ posto marcho di Checho e comp[a] scarpellatori debino aver in questo 25 sono per bra. 14 1/4 di doppie di pietre di macigno cian[n]o lavorate sullavorio di san Lorenzo per lo primo pilastro della tribuna a rag_ di L. 21 il braccio di loro maistero le quali furono dalla base in su______L. 299

Item a di detto L. xxxvi s. xvi posto I detto marcho e comp[a] debino aver in questo 25 sono per bra. 30 2/3 di chornici e architravi nan[n]o lavorate a rag_ di s. 24 il braccio di loro maistero______L. 36.16

DOCUMENT 1443c

1443 **September 10. Record of payment of 309 *lire*, 15 *soldi* to Salvadore di Nencio for supervising construction of one of the freestanding crossing piers. Payment is for $14^{3/4}$ braccia of pier, "from the base to the capitals" (*con la basa perfino al pari de capitelli*).** [Hyman, 1968, p. 464; for discussion *ibid*., p. 332.]

Item a di settembre L. cccviiii_ s. xv posto Salvadore di nencio scarpellatore debi avere in questo 34 sono per 1_ pilastro di macigno e lavoro fu bra. 14 3/4 con la basa perfino al pari de capitelli per L. 21 il braccio di suo maistero L. 309.15.

DOCUMENT 1444a

1444 Reference to "l'altare di sto Antonio dalla porta alla stupha tra due pilastri a pie di Sto Gregorio" (the altar of St Anthony at the porta della Stufa between two piers at the foot of St Gregory). (ACSL 1938 36r).

Discussion: Inserted directly from e-mail from Elam to Matthew A. Cohen, 28 April 2010. Needs to be edited.

DOCUMENT 1445a

1445 **February 13 (modern style).** Lotteringho d'Andrea della Stufa buried nel mezzo alla porta della Stufa (ACSL 1938 36v)

Discussion: Inserted directly from e-mail from Elam to Matthew A. Cohen, 28 April 2010. Needs to be edited.

DOCUMENT 1446a

1446 **March 9 (new style). Request by the prior and canons of San Lorenzo to the bishop of Florence for the right to allocate patronage to the remaining chapels in the new church—apparently the nave chapels—to whomever they wish, so that the church might be brought more quickly to completion.** [Book 41 of the Camerlinghi antichi, letter L, maintained by Piero di Michele Cappellano, p. 104 t., as described in: Moreni, I, 1816, p. 9 n. 1.]

"Ricordo come a di 9 di Maggio (1445) ci ragunammo in Capitolo el Priore, e tutti e' canonici, e deliberossi d'addimandare licentia dall' Ordinario, cioè dal Vescovado di potere allogare, e concedere i luoghi delle Cappelle della Chiesa nuova a qualunque persona ci piacessi, o paressi, acciocchè la Chiesa avessi più presto perfetione, e compimento, e a questo dimandare fecero me Sindacho, et procuratore, e di questo fu rogato Ser Bartolommeo del Bambaciajo, e a di 10 ancora ci ragunammo, e facemmo sopra di ciò tractato come nelli atti si costuma di fare, e di questo anchora fu rogato Ser Bartolommeo sopraddetto; e fatta la petitione al Veschovado al Banco Mess. Chatelano al presente Vichario choncedette a noi licentia di questo potere fare chon quelli atti si richieggono, e di questo fu rogato Ser Iacopo da Romena Notajo del Veschovado, e anchora Ser Bartolommeo sopradetto."

DOCUMENT 1446b

1446 **March 17 (new style). Record of payment for 12 2/3 braccia of pilaster trim for the high altar chapel.** [Hyman, 1968, p. 474.]

...per bra. 12 2/3 di pilastri di macigno che ma[n]cavano a pilastri delle capella magiore a rag^{o} di L. 9 il braccio________L. 114

DOCUMENT 1446c

1446 **March 22 (new style): Record of payment to Giovanni di Bartolo "and companions" for five firwood timbers to be used for models of the nave columns.** [Hyman, 1968, p. 475; see discussion, *ibid*., p. 337.]

Item a di detto L. 1 s. 7 demo a giovan[n]i di bartolo e comp^{a} legnaiuolo per 5 assi dabete per fare modelli per le colon[n]e pagho il banco per nome del priore e capitolo in questo *166* *_____L. 1.7*

DOCUMENT 1446d

1446 **April 16. Death of Brunelleschi.** [Gabella dei Contratti, Libro A. 82, c. 209 (today lost), quoted in Procacci, 1980, p. 55 n. 30, after Strozzi and Del Migliore.]

Discussion: The words quoted below appeared next to the registration of Brunelleschi's testament. The following pasages from this document, which is now lost, were transcribed by two eighteenth century authors, C. Strozzi, and Leopoldo Del Migliore. Vasari provides the same date, April 16, 1446, for Brunelleschi's death, as does an inventory of Brunelleschi's possessions, completed upon his death. Two documents from the *opera* of the Cathedral of Florence, however, indicate that Brunelleschi's salary ended on April 15. To resolve this confusion, Guasti suggests that Brunellschi could have died "at daybreak" on the 16th, and Milanesi similarly suggests that he could have died on the night of the 15th, and that the death was not recorded until the 16th (see Procacci, *Ibid.*).

decessit die 16 aprilis 1446

DOCUMENT 1446e

1446 **July 29. Record of advance payment of 200 *lire* to *scarpellatori* Ciecchino d'Andrea Giaggio and Simone di Piero Baccielli of Settignano for "6 large columns of macigno."** [Hyman, 1968, p. 538; see discussion, *ibid*., p. 337.]

Ciecchino dandrea di giaggio, Simone di piero baccielli da settignano scarpellatori e *ciascuno di loro in tutto deono dare a di 29 di luglio L.200 a piccioli e bono dalbanco per nome del priore e capitolo in questo 82 I quali per stanno loro sonopere 6 colonne grandi di macigno ci debono fare.*

DOCUMENT 1446f

1446 **October 24. Record of payment of 110 *lire* to Andrea di Giovanni and brothers for excavation of the foundations for *8 pilastri* (columns).** [Hyman, 1968, p. 484.]

Discussion: The number of columns noted in this record is probably in error, for only six nave columns are under construction during this construction phase (see Hyman, 1968, pp. 341–342). [note: pilastri could be piers—check use of the terms for columns; does it mean six nave columns and two crossing piers?]

Item a di 24 dottobre 1446 L. ciento dieci s. ii posto andrea di giovanni e fratelli che cavano i fondamenti debino avere in questo 101 sono per cavatura e rienpitura e portare via la terra di bra. 826 di fondamenti fatti per 8 pilastri a rag^{o} di s. 2 d. 8 il braccio ______L. 110.2.

DOCUMENT 1447a

1447 **No month provided. Testament of Ugolino di Niccolò Martelli and brothers affirming their family commitment, established in their father's will of 1423, to build a chapel "with others," and that at the time of the testament construction was underway.** [Catasto 1447 Fa. 678 f. 1411 v. (Archivio di Stato), from Pudelko, p. 60, n. 2, brackets are Pudelko's.]

Discussion: The chapel in question is the Cappella degli Operai (see Docs. 1422c, 1423c, 1427c, 1449L, 1463a.

Dichiarazione di Ugolino di Niccolò Martelli e fratelli [comincia f. 1409]. *Abbiamo per testamento di nostro padre fatto insino lanno 1423 di giugno a dì VI roghato Gerontino da Montecatini dovesse fare a chomune chon altri una chapella per santo lorenzo la quale si lavorava al chontinuo e fa… ci tochera in nostra parte di spesa f. L… incircha.*

DOCUMENT 1447b

1447 **March 8 (new style). Record of payment of 13 lire, 7 soldi to Salvestro di Giovanni for construction of the roof of the high altar chapel.** [Hyman, 1968, p. 544; see discussion, *ibid*., p. 340.]

Item a di 8 di marzo L. 13. 7 demo a salvestro di giovanni muratore perlo contanti sono per opere 12 lavoro lui a luca suo fratello per fare il tetto nella capella maggiore....

DOCUMENT 1448a

1448 **February 3 (new style). Record of payment for the transportation of one nave column shaft from the quarry at Ghonfolina to the Porta a San Frediano in Florence.** [Hyman, 1968, p. 538; see discussion, *ibid*., p. 344.]

Item a di 3 di febraio 1447 L. 76 demo per loro a paolo di checho da ghanghalandi per conductura di 1ª colonna da ghonfolina dalla porta a san friano [San Frediano]/ pagho il banco per nome del priore e capitolo.

DOCUMENT 1448b

1448 **February 19 (new style). Record of payment for the transportation of another nave column shaft from an unspecified quarry.** [Hyman, 1968, p. 538.]

Discussion: Compared to preceding years, the past year's construction activity has been minimal, as the arrival of the nave columns is awaited. The transept, therefore, is probably largely complete by now, the only significant work remaining in the nave (see discussion, *ibid.*, pp. 344–345).

Item a di 19 detto L. 24 demo per loro a tingho di lorenzo scafaiuolo per parte di conductura di 1ª colonna pago il banco per nome del priore e capitolo.

DOCUMENT 1448c

1448 **March 29. Record of payment of 19 <u>lire</u> to wheelwright Michele di Nanni di Ghoro for the transportation of two capitals (presumably column capitals) from a quarry in Settignano.** [Hyman, 1968, p. 538.]

Item a di detto L.19 demo a michele di nanni di ghoro carradore perlo contanti per vetti di due capitelli di macigno cireco dallcava dal caprino da settignano.

DOCUMENT 1448d

1448 **May 13. Record of payment of 12 *lire*, 4 *soldi* to carpenter Benedetto di Domenico for his work on a door, *2 arghani* (hoists), and other equipment in the Rondinelli chapel.** [Hyman, 1968, p. 494; see discussion, *ibid.*, p. 347.]

Item deono dare a di 13 di maggio 1448 L.xii s.iiii demo a Benedetto di domenico lagnaiuolo perlo contanti sono perfino maistero di due argani e 4 caprette e 1ª porta che va alla capella de ro[n]dinelli pago B.S. in questo <u>166 L</u>. 12.4

DOCUMENT 1448e

1448 **June 20. Record of payment of 48 *lire* to sculptor Maso di Matteo–probably one of the Rossellino brothers–for "two seraphim friezes which go above the columns" (*due fregi di serafini che van*[n]*o sopra le colon*[n]*e*)–i.e., two carved friezes for two of the entablature blocks.** [Hyman, 1968, p. 496; see discussion, *ibid.*, p. 349.]

Item fino a di 20 di giug[n]o L. quarantotto demo a Maso di matteo intagliatore per maistero di due fregi di serafini che van[n]o sopra le colon[n]e pago il bancho per nome del priore e capitolo in questo <u>157 L. 48</u>.

DOCUMENT 1448f

1448 **July 30. Record of payment of just under 10 *lire* to mason Bindo di Franco for supervising construction of 146 *braccia* of brick wall, which included the doors in either side of the nave, nearest the transept.** [Hyman, 1968, p. 497; see discussion, *ibid.*, pp. 350–351.]

Discussion: The doors are located in the nave between SP 8–SP 9 and SP 66–SP 67. The *porta dellopera* ("the door of the *opera*") is the door presently leading to the cloister. Evidently the *opera* based its operations on that location in 1448. The *porta dal campanile* ("the door of the campanile") opened to a space immediately behind the old campanile, which stood between SP 66–67, probably until 1481 (Doc. 1481a).

> *Item a di 30 detto L. viiii_ s.xviiii_ d.vii demo a Bindo di franc_ muratore perlo contenti per suo maistero di bra. 146 di muro ciafatto di mattoni sopra mattoni dalla porta dellopera/ e dalla po[r]ta dal campanile/ pagho B.S. in questo* <u>*185*</u> *L. 9.19.8*

DOCUMENT 1448g

1448 **September 10. Record of payment of 43 *lire* to Nicolo del Maria for two crossing pilaster capitals.** [Hyman, 1968, p. 499; see discussion, *ibid*., p. 353.]

> *Item a di 10 detto L. quarantatre posto nicolo del maria scarpellatore debi avere in questo 194 sono per suo maistero di due capitelli di macigno cia abozati che an[n]o andare sopra il pilastro quadro maggiore______L. 43.*

DOCUMENT 1448h

1448 **September 19. Record of the commitment of 100 gold florins by the family of Luca di Marco to be used for the construction of their chapel (SP 60–SP 63).** [Hyman, 1968, p. 544.]

Discussion: See Doc. 1450a.

> *Ricordo questo di settembre 1448 ci disse il priore di san lorenzo avere avuto dalmonte fiorini ciento doro de danari delle paghe di Luca di Marco che fanno a spendere nella muraglia della capella di detta luca/ I quali Fiorini 100 di oro dicie il priore avergli a operati per paghare 6 granezze overo in poste del priore e capitolo di san lorenzo/ I quali intende rendere in questo modo cioe fiorini 50 doro ci promette dare Messer Giovanni di Lionardo calonaco e cam*[o] *di san Lorenzo per di qui a tutto il mese di maggio 1449/ I gli altri fiorini 50 promette avere rendute per di qui a tutto novembre 1449.*

DOCUMENT 1448i

1448 **September 24: Record of payment of 1110 <u>lire</u> to Ciecchino d'Andrea Giaggio and his associates for three columns, complete with bases and capitals.** [Hyman, 1968, p. 539.]

> *Ciecchino di giaggio e comp*[a] *contrascritti deono avere a di 24 di settembre 1448 L.1110 sono per 3 colonne grandi di macigno abozate colle base e capitelli cianno mandate per L.370 luno condotte nellavorio.*

DOCUMENT 1448j

1448 **September 28. Two records of payment of 16 <u>lire</u> to master mason Chechino di Giaggio for unspecified improvements (*miglioramento*) to four capitals that he had mistakenly made from *falda grossa di macigno*, an inferior quality stone, rather than the stronger *masso di macigno.*** [Hyman, 1968, pp. 500 and 539; see discussion, *ibid*., p. 352].

Discussion: The "improvements" probably entail replacing various parts of the capitals that evidently broke off due to the brittleness of the stone. These parts include corner volutes, abacus tips, and leaf projections. They are replaced with carefully carved wooden replacements, bolted and screwed into place, and perhaps painted to match the surrounding stone (Observations Fig. 12, left volute and abacus corner). The cost of the wood carving is comparable to that of stone carving. The cost of roughing out one capital, for example, is 70 lire (Docs. 1448L and 1449d), and one carved "serafim" entablature block frieze costs 24 lire (Docs. 1448e and 1449g).

Item a di detto L. xvi posto checino detto e comp[a] debino avere in questo 95 sono per miglioramento di 4 capitelli di macigno abozate che van[n]o sopra le colon[n]e grandi I quali si doveano fare di masso/ e an[n]o cieli fatti di falda grossa di macigno_______L. 16
(p. 500)

Item a di detto L. 16 per miglioramento di 4 capitelli di macigno perlo sopradette colonne I quali ciaveano fare di masso e anno cgli [sic.] fatti di falda grossa posto a Spese 190.
(p. 539)

DOCUMENT 1448k

1448 **October 11: Record of payment of 11 lire, 13 soldi for transportation of "...the last column..."–i.e., the sixth of the six columns contracted to Ciecchino d'Andrea Giaggio and Simone di Piero Baccielli**. [Hyman, 1968, p. 540.]

Item a di 11 dottobre 1448 L. 11.13 demo per loro a tingho di brucianese scafaiuolo perlo contanti che L. 7 sono per resto della portatura del ultima colonna e L. 4.14 sono per ragione avea con Ciecchino sopradetto.

DOCUMENT 1448L

1448 **October 26: Two records of payment of 70 lire to scarpellatore Giovanni di Bertino for the completion of one column capital, which had been previously roughed out.** [Hyman, 1968, p. 540.]

Item a di detto L. 70 posto giovanni di bertino scarpellatore debi avere in questo 91 sono per suo maistero di piu opere misse a lavorare 1_ capitello di macigno di 1[a] delle colonne grandi il quale era abozate/ e fornillo del tutto.

Giovanni di Bertino scarpellatore de avere a di 26 dottobre 1448 L. 70 sono per maistero di 1_ capitello della colonna grande che cia abozato e fornillo del tutto.

DOCUMENT 1449a

1449 **February 5 (new style): Record of payment for the transport of one capital roughed out at the quarry at Settignano by *scarpellatore* Pagno di Lapo Portigiani.** [Archivio del Capitolo di S. Lorenzo, "Entrata e uscita…" (For full reference see Doc. 1442b), from Hyman, 1975, p. 117 Doc. 41.]

Discussion: This document records payment for one of at least two capitals roughed out by Pagno (Doc.). Whether these capital was destined for the Palazzo Medici or the basilica of San Lorenzo is unknown. Pago was to serve as capomaestro of the basilica project by 1462

(Doc. 1462a), and may have played a major supervisory role in the 1440s as well. (See Hyman, ibid., p. 111; and Hyman, 1968, p. 356.)

> *Pagno di Lapo scarpellatore de dare a di v di febraio 1448* [1449] *L. viiii° 1/2 posto antonio di gietto carradore debi avere in q*[uesto] *198 per vettura di 1° capitello li reco dalla cava del caprino da settignano*... [fol. 225 left]

DOCUMENT 1449b

1449 **February 10 (new style): Record of payment of 7 lire to painter Piero di Lorenzo for colors, and for supervising their application to coats of arms which he designed for the ceiling coffers in the transept near the Cappella Rondinelli.** [Hyman, 1968, p. 505; see discussion, *ibid*., p. 356.]

> *Item a di 10 di febraio 1448 L. sette demo a piero di lore[n]zo dipintore perlo contanti sono per suo maistero e per colori messi di due armi fatte nel serraglio delle volte allato alla capella de rondinelli pagho B.S. in questo 226________L. 7*

DOCUMENT 1449c

1449 **February 28 (new style): Record of payment of 14 *lire* to sculptor Domenico di Sandro for his *maistero* of "...two squares of architrave of macigno which go over the capitals of the columns."** [Hyman, 1968, p. 541.]

> *Item infino a di 28 di febraio 1448 L. 14 demo a domenico di sandro scarpellatore perlo contanti per amistero di due quadri darchitravi di macigno che vanno sopra i capitelli delle colonne.*

DOCUMENT 1449d

1449 **March 12 (new style): Record of payment of 70 *lire* to *scarpellatore* Nanni di Miniato for roughing out one capital, intended to go "...above one of the large columns in one piece...."** [Hyman, 1968, p. 542; see discussion, *ibid*., p. 358.]

> *Item a di 12 di marzo 1448 L. 70 posto nanni di miniato vocato fora scarpellatore debi avere in questo 206 [cross-reference to folio 206 in the ledger] sono per maistero di 1_ capitello di macigno che era abozato il quale cia fornito del tutto che va sopra 1ª delle colonne grande di 1_ pezzo.*

DOCUMENT 1449e

1449 **March 21 (new style): Record of payment of 70 *lire* to *scarpellatore* Giovanni del Bertino for roughing out one capital for "the big columns."** [Hyman, 1968, p. 542; see discussion, *ibid*., p. 358.]

> *Item a di 21 di marzo 1448 L. 70 posto giovanni del bertino scarpellatore debi avere in questo 228 sono per maistero di 1_ capitello di macigno chera abozato il quale cia fornito del tutto per le colonne grandi.*

DOCUMENT 1449f

1449 **March 24 (new style): Record of payment of 80 *lire* to *scarpellatore* Meo di Saccho and companions for two arches, probably for the nave arcades.** [Hyman, 1968, p. 543.]

Meo di Saccho e comp[a] scarpellatori sono per 2 archi in questo 231_______L. 80.

DOCUMENT 1449g

1449 **March 31: Record of payment of 48 *lire* to sculptor Antonio di Matteo for his *maistero* of "...two friezes of seraphim already carved which go above the large columns."** [Hyman, 1968, p. 511.]

Item a di 31 detto L. quarantotto demo a dantonio di matteo intagliatore perlo contanti sono per maistero di due fregi di serafini cia intagliati che van[n]o sopra le colon[n]e grandi pago B.S. in questo 237_________L. 48.

DOCUMENT 1449h

1449 **May 10: Record of payment for the transport of one capital roughed out at the quarry at Settignano by *scarpellatore* Pagno di Lapo Portigiani.** [Archivio del Capitolo di S. Lorenzo, "Entrata e uscita…" (For full reference see Doc. 1442b), from Hyman, 1975, p. 117 Doc. 42.]

Discussion: See Doc. 1449a.

Item a di 10 di maggio 1449 L. xii posto michele di nanni di ghoro carradore debi avere in q[uest]*o 245 per vett*[ur]*a di 1[o] capitello grande di macigno ci reco da settignano dalla cava del caprino che va sopra I[a] delle colonne grandi di detto Pagno…* [fol. 225 left]

DOCUMENT 1449i

1449 **June 28: Record of payment of 60 *lire* to *scarpellatori* Meo di Saccho and companions for the manufacture of two arches to go above the columns in the northern arcade.** [Hyman, 1968, p. 543.]

Discussion: In this document the old campanile, which stood on the site of the Medici chapel located between SP 67 and SP 68, is used as a location reference.

Item a di 28 di giungo 1449 L. 60 e bono contanti da B.S. in questo 250 perlo meo detto furono due archi dal campanile sopra le colonne tonde.

DOCUMENT 1449j

1449 **August 16: Record of payment of just under 23 *lire* to Salmi Maroghi da Fiesole, quarryman, for $2^{1/3}$ cart loads of stone to be used for the crossing arches.** [Hyman, 1968, p. 514; see discussion, *ibid.*, p. 359.]

Item a di 16 dagosto L.22 s.19 d.6 post salmi maroghi da fiesole cavaiuolo debi avere in questo 257 sono per carrate 2 1/3 di pietre di macigno aute dalluj co[n]dotte nellavorio che bisognoro per li archi grandi_______L. 22.19.6.

DOCUMENT 1449k

1449 **November 25: Two records of payment of 140 *lire* to *scarpellatori* Meo di Saccho and Betto di Santi for the manufacture of two arches, to be placed in the north arcade.** [Hyman, 1968, pp. 515 and 543; see discussion, *ibid*., pp. 359–360.]

Discussion: Note that the manufacture of an arch costs about as much as that of a capital (Docs. 1448L and 1449d). Furthermore, the arches were apparently not interchangeable, but made to fit specific locations in the church, in this case, the north arcade.

Item a di detto L. cientoquaranta posto meo di seccho e betto di santi scarpellatori debino avere in questo <u>*231*</u> *sono per maistero di due archi cian[n]o fatti che van[n]o sopra le colon[n]e grandi dallato di verso il campanile per L.70 lino di loro maistero______L.140* (p. 515).

Meo di saccho e betto di santi scarpellatori deono avere a di 25 di novembre 1449 L. 140 sono per loro maistero di due archi cianno lavorati che vanno sopra le colonne grandi
(p. 543).

DOCUMENT 1449L

1449 **December 24: Record of payments to *scarpellatore* Nicolo del Maria for a variety of *macigno* components, from columns to rain gutters.** [Hyman, 1968, p. 516; and discussion, p. 337.]

Discussion (a): The following excerpt from the San Lorenzo construction ledger shows the variety of disparate components manufactured by individual *botteghe* as the basilica took shape as a large, centrally coordinated contruction project. This excerpt records payments to the *bottega* headed by Nicolo del Maria (*nicolo del maria e comp[a]*), which in the documented pay period manufactured or finished column bases and shafts, crossing arch voussoirs, exterior architrave and cornice segments, foliate consoles, and parts of clerestory window surrounds.
Discussion (b): This excerpt is also notable for its precise architectural references. In four of the line items, the old campanile, still standing in 1449 on the site of the present chapel between Step Pilasters 66 and 67, is used as a locational of reference (cf. Doc. 1449k). Three of the consoles mentioned in the document are to be placed *sotto londe*, probably a reference to the strigilated exterior frieze, which the author of the document seems to be calling a "wave" (*l'onde*) molding.
Discussion (c): The reference to $17\frac{2}{3}$ br. of stone gutter (*doccie di macigno*) demonstrates that the Cappella degli Operai was still under construction, but approaching completion.

Item a di 24 dicembre 1449 per maistero di piu concio di macigno cia fatto nicolo del maria e comp[a] come a presso di remo
per con[n]atura di due base perle colonne grandi tonde L. 24
per con[n]atura di due colon[n]e grandi cioe il fuso L.100
per due cimase cogli architravi insieme/ sopra le dette colon[n]e fuone[?] bra. 14 5/6 per s. 58 il braccio montano L. 43
per con[n]atura di due archi grandi per la tribuna L. 520
per bra. 38 1/2 di cornici intagliata fornita sopra 2 archi grandi per L.3 il braccio

L.115.10
per bra. 10 di detta cornice murata dalato dal campanile L. 30
per bra. 17 di architravi a rag^{o} di s. 25 il braccio L. 21.15
per bra. 22 1/2 darchitravi dal campanile dallato di fuori s.25 il bra. monta L. 28.2.6
per 6 mensole murate cioe 3 sotto londe dal campanile e due dentro sotto il corridoio e 1^{a} sotto il frontone a rag^{o} di s.45 luna montano L. 13.10
per 3 stipiti pelati di fuori e 1^{o} per dentro a rag^{o} di L. 7 luno L. 21
per 6 pezi darchetti per finestre a rag^{o} di L. 4 luno L. 24
per 1^{a} finestra fornita murata sopra la nave dal campanile L. 60
per bra. 17 2/3 di doccie di macigno allato alla capella degli operai a rag^{o} di s.15 il bra. L. 3.5
Som[m]a L.1017 s.16 d.6 posto nicolo del maria e comp^{a} 1017.16.6
sopradette debino avere in questo 221 101716.6

DOCUMENT 1450a

1450 **January 31 (new style): Record of payment of 100 *lire* to Nicolo del Maria and his workshop.** [Hyman, 1968, p. 545; for discussion see: *ibid*., p. 353.]

Discussion: The *contrascritto ricordo* ("the *ricordo* written on the facing page") to which this document refers is Doc. 1448h, a document that pertains to construction of the Chapel of Luca di Marco. Since Nicolo del Maria made some of the capitals of the crossing pilasters (Doc. 1448g), the present document suggests that he made some of the distinctive capitals of the aforementione chapel as well.

Il capitolo di san lorenzo per ragione del contrascritto ricordo de avere a di 31 di Gienaio 1449 L. 100 de quali contentono per noi nicolo del maria e comp^{a} in questo 221

DOCUMENT 1450b

1450 **February 5 (new style): Three records of payment to carpenter Fano di Bartolommeo for wooden beams, trusses, and moldings for the roof, presumably over the nave.** [Hyman, 1968, p. 546; see discussion, *ibid*., p. 361.]

Fano di Bartolommeo legnaiuolo de avere a di 5 di febraio 1449 L. 132 per 3 abete grande di bra. 22 luno per asticiuole di canalletti della chiesa.

Item a di detto L. 34 per due abete di bra. 12 luno per puntone de canalletti.

Item a di detto L. 41.13.4 per 5 abete de bra. 22 luno e circa per arcali dell tetto della chiesa.

DOCUMENT 1451a

1451 **September 23: Record of payment for the replacment of 18 large stones intended for the crown molding at the base of the dome which, because of their curved shapes, were damaged during transport from the quarry.** [Hyman, 1968, p. 520; see discussion, *ibid*., pp. 362–363.]

Item a di detto L.xiii 1/2 posto checho sopradetto debi avere in questo 279 sono per soprime[n]to di 18 pietre grandi ciamandate che ffurono 18 carrate per la tribuna dentro cioe per la cornici che va sulpiano de gli archi della tribuna/ che ffurono pietre volte in tondo delle quali e stato pagato per L. 8 s.l la carrata come delaltre pietre e questi piu lidiamo perche betto cia fatto fe de che il priore li promesse di darglile perche no[n]volea mandarciele perche molta pietra venia astraziare pel tondo______L. 13.10

DOCUMENT 1451b

1451 **?: Cianfogni or Moreni document pertaining to tramezzo in old San Lorenzo**

Pacciani

DOCUMENT 1453a

1453 **April 20: Record of payments to glazier Maestro Agnolo for glass for the oculi of the Old Sacristy, and repairs to the Old Sacristy lantern.** [Hyman, 1968, pp. 546–547, brackets are mine.]

Discussion: In 1438, Maestro Agnolo also supplied glass for the windows of the Cathedral of Florence (Hyman, *ibid.*, p. 364).

Item a di 20 daprile 1453 Lire 2.5 per lui Amcolaro bichiero perlo giovanni di bartolommeo contanti sono per lib. 9 docchi di vetro aute dallui

Item a di detto L. 5.1 perlo maestro agnolo detto contanti

April 2 [sic. should be 20?] *Chosimo de' Medici de dare per libre 9 d'ochi di vetro sono per la finestra dela sacrestia dela chappola di sSa' Lorenzo// Nicholaio// bichieraio L. – s. 5*

Agnolo de Vetri a'vere per vernice liquida e geso soldi undici

Nofri// E de avere L. 18 per raconciatura della lanterna della sagrestia, fattura di vetro e reti.

DOCUMENT 1453b

1453 **June 9. Record of payment by Zanobi di Ser Gino Ginori for a ledger book and the first cartloads of stone puruant to construction of his double chapel dedicated to S. Nicolo.** [Capitolo di San Lorenzo, *Entrata e uscita di spese fatte per la fabbrica delle cappelle del Ginori—Cambini—Neroni et altre e della muraglia dell'alb^{o} della corona, Avere*, from: Roselli and Superchi, 1980, p. 104.]

C.lv — MCCCCliij

Lachappella emuramento di S.to nicholo diginoli overo zanobi ginoli posta nella chiesa di S.to Lorenzo di firenze dedare adi 9 digiugno soldi venti per il presente libro e per uno quadernuccio e fogli pertenere conti della detta chappella

Ededare conto di lire venticinque lequali detti a checho chaprino per incominciamento di pagamento di charrate di pietra per detta cappella in questo a sua ragione…

DOCUMENT 1454a

1454 **June 2. Record of payment by Zanobi di Ser Gino Ginori for window moldings pilaster components such as capitals, and other architectural ornament for the Cappella Ginori (northern double chapel).** [Capitolo di San Lorenzo, *Entrata e uscita di spese fatte per la fabbrica delle cappelle del Ginori—Cambini—Neroni et altre e della muraglia dell'alb^{o} della corona, Avere*, from Roselli and Superchi, 1980, p. 114.]

C.3r — MCCCCLiij

Edeavere perinfino adi 22 digiugno 1454 perlavorare allapietra forte antonio

Edeavere perfacitura diduo finestre dachordo lire cento settantatre perlacappella deginoli cioe finestre quadre

Edeavere perlavoratura ditre canti cioe base canti ecapitelli intutto dachordo lire settantacinque

Edeavere perlavoratura dunomezzo pilastro cioe conbase ecapitello dachordo intutto lire sessanta

Edeavere perbraccia quarantadue di cornice colluona e architravi insieme per soldi cinquantotto il braccio intutto dachordo lire centoventuno esoldi sedici

Edeavere per achonciatura diduo mensole cioe opera una emezzo soldi trenta…

DOCUMENT 1456a

1456 **May 2: Record of payment of 7 <u>lire</u>, 4 <u>soldi</u> for a supper held by the Chapter of San Lorenzo, attended by master masons and workers, when the cupola was about to be closed.** [*ASCL 2302*, v. 115, from Saalman, 1993, p. 439, Document 9.]

...adi ij di magio metto a uscita lire sette e s. quattro per deliberazione del chapitolo per fare el desinare a maestri e manovaly quando chiusono la cupola chome apare al quaderno di richordanze segnato B c.14.

DOCUMENT 1457a

1457 **April 2: Records of payment for *pietra serena* stonework installed in the Ginori Chapel (double chapel at north end of transept).** [Capitolo di San Lorenzo, *Entrata e uscita di spese fatte per la fabbrica delle cappelle del Ginori—Cambini—Neroni et altre e della muraglia dell'alb^{o} della corona, Avere*, excerpts from the transcription of: Roselli and Superchi, 1980, pp. 118-119.]

Discussion (a): The following is an excerpt from a ledger of expenses covering the period from June 9, 1453 to February 9, 1459 (new style). It records expenses incurred as the chapel neared completion after three years of construction. In November, 1457, Ginori would begin construction of the adjacent Ginori corridor, on the site of the present New Sacristy (see Docs. 1422a, 1423e, 1453b, 1454a).

C.12r — MCCClvj [But note that expenses on this sheet extend into 1457]

…Epiu deavere dadi 2 daprile 1457 infino adì 18 diluglio percharrate dieci recho andrea detto mulacchio lire novanta esoldi dieci cioe unarme conun pezzo dochio per

il frontone, due pezzi di cornice dimezzo bastone 3 cornice grossa dighalazzone etre gronde intutto pezzi dieci

Epiu per charrate sette recho michele ghori dadi 2 daprile infino adi 18 diluglio cioe 2 pezzi dochio per il frontone 2 pezzi dichornice di mezzo bastone 2 pezzi di chornice grossa dighalazzone una gronda intutto…

DOCUMENT 1457b

1457 **May 1: Letter by Giovanni di Domenico da Gaiole to Giovanni de'Medici in which da Gaiole claims to have been physically assaulted after a meeting of various *maestri* during which he questioned the design of the recently completed crossing dome, and the enclosing superstructure then under construction. <u>Both structures were the work of Antonio di Manetto Ciaccheri</u> (?). Da Gaiole claims to have expressed Cosimo de Medici's concern that the dome, according to the present design, would weigh two million pounds more than originally planned. He then quotes Antonio Marelli, a friend of Cosimo's, who believed it would be cheaper and safer to demolish the dome and rebuild it according to Brunelleschi's design, which Marelli believed to be light, strong, well illuminated, and well proportioned, than to continue to continue with the present unsuitable project.** [*Archivio Mediceo l. c. filza 9*; from: Gaye, I, 1839, pp. 167–169.]

Discussion: See Saalman, 1993, pp. 179–183.

Riverendo Magnifico mio. Solo per avisarvi chome a dì 2 del presente fui hofeso da uno, chi a nome barnabo, aspramente a stanza d'antonio di manetto legnaiuolo, e perchè voi intendiate la chagione, io me trovai in chasa vostra, innell'anticamera di cosimo per mie facciende e di piero vostro, ed eravi antonio martelli e antonio manetti e altri; e disputavano sopra allavoro di Sco. Lorenzo. e sendo dimandato di mio parere sicondo loro disputa, io confermai il detto di cosimo, perchè cosimo domandava dellume della giunta faceva sopra detta tribuna, e che a cosimo parea 2 milioni de pese più chel dovere. Io tornai a bottega, e chome desideroso chelle vostre hopere fussono quanto a voi debitamente si confanno, pratichai con uno mio giovane bottega, e mandàlo a Sco. Lorenzo. e in fine conchiudemo avere manchamento. e perchè in qu' dì era pichola cosa fatto, intorno a detto Manchamento secondo nostro parere dissi ad angelo della stufa, perchè io so chè afezzionatissimo in vostre opere, che diciesse chè uno M._, e non nominasse me; per dubio avevo che assai volte si presta fede a uno, che à un pocho dacidentale con molti viri, che a uno che viva honestamente et costumato. Risposemi in modo meritassi da lanprese. dipoi circha a uno mese o più, Masaltò detto barnabo e antonio in sul canto della via largha; e si non che dio maiutò che vi si battè in quello francesco ghirlani, e dissene loro male, mi facevano male. veduto non avere io parlato di questa materia circha di dì più di 40, stimai per quell' atto chel lavoro fusse a sua termini. andai a sco. ispirito, che mi vi mandò antonio guidotti, et vidi uno modello, come aveva a essere questa. molto me dolse per lamore vi porto, dissi antonio Martelli chome el lavoro istava, e che sicondo di nuove avevo inteso, che gli era meno ispesa a disfare e rifare quella tribuna nel modo di filippo, chè legiera, forte, alluminata, e di proporzione, che seguire lo inconveniente. e per queste parole antonio mi dette a dir di questo dopo desinare un modello, e comandòmi cheio andasse a chosimo e diciessegli le parole sopradette. Io andai a Sco. Lorenzo al figliolo di betto iscarpellatore, e dissegli che mi desse uno modello, chegli à di questo lavoro. disse che se chosimo gliene chiedeva, gliene darebbe; altromenti nò. Io gli dissi, che dandoci cosimo et suo famiglia guadagnio, noi siano tenuti avisarlo dogni cosa, che noi vedessimo e udessimo delle sue facciende; che annoi istà lavisarlo, e allui el pigliare partito. dissimi non lo voleva fare, e io gli disse: tu qui sei chagione di questo; che sittu lavessi mostro nel principio, non era questo, anche meglio tardi, che non mai; e piutosto avisarò lamico nel principio che nel fine. e poi mi partii per andare a cosimo. in sul chanto della via del cocomero masaltò detto barnaba, mandato da detto antonio,

e à mi laciero in modo che avendo fatto loro una grande ingiuria, bastarebbe. hora io vi prego, che voi mi prestate aiuto, favore come uno servo etc. etc.
a di 1._ Magio 1457

giovanni di Domenicho
de gaiole.

INTERPOLATED DOCUMENT 1457c

(1457) **Excerpt from the *Life of Filippo Brunelleschi* by Antonio di Tuccio Manetti lamenting the design of the crossing dome, which was completed in 1457.** [Manetti, 1976, pp. 110–111.]

Discussion: Like da Gaiole, Manetti believes that Brunelleschi's design would have been lighter, stronger, more beautiful, and better proportioned than the present design. The comments of da Gaiole and Manetti imply the existence of a model of Brunelleschi's project, although no such model is ever mentioned. By the early eighteenth century the dome appeared to be on the verge of collapse, and a major program of structural repair was undertaken (see Ruschi in *San Lorenzo 393-1993*, 1993, pp. 151—156).

...né tirata su la tribuna del mezzo; la quale tribunetta si fece in tutto, e di drento e di fuori, molto discosto alla intenzione di Filippo. E questa è la cagione, che la non piace anche a chi ne dà carico a Filippo; el quale faceva le cose sue con molte varie considerazioni intorno alle adornezze e fortezze, che quivi non'è nessuna, ma appariscevi tutto el contrario; per che e lavorìo crebbe di spesa, e mancò di bellezze di drento e di fuori, e mancò di lumi e di lanterna e di proporzione di corpi, ed acrebbe di peso assai più che non si conveniva a' pilastri che 'l sopportano.

DOCUMENT 1457d

1457 **May 15: The church canons hold a dinner to celebrate the "beginning of the construction of the new cloister."** [Moreni, I, 1816, p. 14, source cited is the *libri dei camarlinghi*.]

Discussion: Construction now proceeds on the cloister, rather than on the remaining portion of the basilica nave, as might be expected. One possible explanation for this construction sequence is suggested by Vespasiano da Bisticci's, biography of Cosimo de' Medici. According to Vespasiano (1421–1498), Cosimo, apparently fearing that he would not live to see the completion of both the church and the cloister, built the cloister first, reasoning that many patrons could be found to build the church if necessary, because of the honor associated with such an undertaking, but that no one would want to build the cloister (see text, "Documents," p. 11).

Item a dì 15. di Magio di comesione, e volontà del Capitolo d' esto dì demo desinare al Proposto di Firenze [Giovanni di Tommaso Spinellini di Castel Fiorentino], *e con esso lui in casa del Priore desinamo tutti, Priore, e canonici, e questo facemo per dare opera, e principio a edificare el Chiostro nuovo, el quale Idio ci dia gratia, che si venga a fare; tanto è tonato, che se ogi mai piovesse, non sarebbe grande fatto.*

DOCUMENT 1457e

1457 **November 10: The Signoria grants permission to Gino Ginori to build a chapel that will encroach on a public street.** [*Carte Strozziane dell'Archivio di Stato di Firenze*, Serie II, cod. 53 (già M. 1211), p. 218. Spoglio di Deliberazioni della Signoria per i mesi di novembre–decembre 1457; from: Ginori Conti, 1940, pp. 82–83; Also published, with significant discrepancies, in Elam, 1979, p. 185, Doc. E.]

Discussion: The corridor/chapel, shown in the Venice plan of c.1499 (“Documents” Fig. 32), and referred to by scholars as the "Ginori corridor," served both as a corridor leading between the transept and Borgo la Noce, and as a burial chapel. It was completed by 1463 (see Doc. 1463a), and was demolished in 1519 to make way for the New Sacristy (Doc. 1519a). The construction of this corridor/chapel suggests that the New Sacristy was not foreseen in the mid-fifteenth century. (For discussions of the complex documentary evidence pertaining to this corridor, see: Elam, 1979, pp. 183–185; Saalman, 1985, p. 207ff; Saalman, 1993, pp. 195–198.)

> *Ginus et alii de Ginolis de Florentia ad quos spectat murare et prosequi muramentum cappelle de Ginolis site in ecclesia Sancti Laurentij de Florentia possint claudere et murare viam existentem apud dictum muramentum, claudendo et murando dictam viam prout voluerint dicti de Ginolis.*

DOCUMENT 1458a

1458 **No month cited. Excerpt from tax return of Gino Ginori, noting that "some doors" funded by Ginori are presently under construction.** [*ASF, Catasto 823, fols. 442v–444v*; from Elam, 1979, p. 185, Document F.]

Discussion: The doors in question are probably the two doors in either end of the Ginori corridor, as Elam suggests (Elam, 1979, p. 183, Appendix II; see also Doc. 1457e).

> *per lla muraglia lascio antonio ginori si faciessino delle porti di sallorenzo che tuttavia si murano al presente.…*

DOCUMENT 1458b

1458 **Letter of 1458 indicating that Giovanni di Cosimo de’ Medici had inquired about the possibility of moving a campanile.** [M. Gualandi, “Aristotele Fioravanti,” in Atti e memorie della regia deputazione di storia patria per le privincie di Romagna, ser., I, IX, 1870, p. 58, cited in Gustina Scaglia, “Drawings of Machines for Architecture from the Early Quattrocento in Italy,” Journal of the Society of Architectural Historians, XXV, 2, 1966, p. 107 n. 58; In 1456 Fioravante moved a campanile in Bologna; cf. Burns in Storia, p. 164 n. 190.]

Discussion:.

DOCUMENT 1459a

1459 **No month cited. One of three anonymous poems describing the incomplete basilica of San Lorenzo, composed in connection with the visits to Florence of Galeazzo Maria Sforza, Duke of Milan, and Pope Pius II in 1459 (modern style).** [Biblioteca Nazionale, Florence, *Cod. Magliabechiano VII, 8, 1121*; formerly *Strozziano 474*; from: Battisti, 1981, p. 192, published with English translation.]

Discussion: The following poem confirms that with the exception of the last four bays of the nave, the church was complete by 1459 (modern style) down to details such as gilded ceiling coffers and window glass. The poem furthermore places the cost of the Old Sacristy at more than 18,000 florins. Of iconographical interest is the characterization of the basilica as representing “a paradise” (*un paradiso*).

Cercando in tutto 'l mondo le più ornate// Chiese di Dio so che parrebbon brutte// Quand'elle fosser poi paragonate// Con San Lorenzo ch'ha le beltà tutte Eccelse, magne, degne e peregine// Fatte murar da Cosimo et construtte.// La maggior nave ha il palco d'oro fine// D'azzurro oltrammarino et pien di rose// Lustranti come stelle mattutine.// Non credo che mai più si magne cose// Si facessero in chiese come quelle// Degne, ammirande et sì miracolose.// Veramente la volta delle stelle// Non mostra più lucente o più serena// Che in San Lorenzo queste cose belle.// Da ogni banda è questa nave piena// Di colonne d'un pezzo grosse e grandi// D'una pietrina gentile et amena// Con capitelli d'intagli ammirandi// Occhi di pietre concie et finestrati// Et lavori di vetro vi son pansi// Et messi in volta vi sono gli altri lati// Delle due navi et è ciascuna snella// Di splendidi gentile et degni ornati.// Un magno altare nella maggior cappella// E dall'un lato è una sagrestia// Che mai più non ne fu una sì bella// Et si meravigliosa et sì giulìa// Che chi la mira fiso par ch'abbagli// Perchè per tutto par che sol vi sia.// Evvi tanti gentili e begli intagli// Di porfidi di vetri e vari marmi// Ch'io non so chosa degna a che l'agguagli.// Nel mezzo è il sepolcro suo che parmi// Che di tant ornamenti belli appaia// Ch'io non saprei a dirgli da qual farmi.// Di più fiorini che diciotto migliaia// È già di questa sagrestia la spesa.// Chi dicessi altro falsamente abbaia.// Or pensa tu quel che verrà la chiesa// Che rappresenta proprio un paradiso// Quando fornita sia come l'è impresa.

DOCUMENT 1459b

1459 **1 February (modern style). Letter by architect Aristotile Fioravanti to Giovanni di Cosimo de' Medici offering to move an unspecified campanile in Florence for a fee of 1,000 gold florins.** [Archivio centrale di Stato in Firenze: Filza 9, car. 349.] Michelangelo Gualandi, *Aristotele Fioravanti: Meccanico ed ingegnere del secolo xv memoria* (Bologna: Regia Tiografia, 1870): 59-60.

Discussion (a): Gualandi introduces the letter as follows: "Torniamo all'anno 1458, 1 febbraio. Lettera (di cui solo la firma è originale) di *Aristotele* diretta a Giovanni di Cosimo de' Medici." The endnote to this intrduction reads: "Archivio centrale di Stato in Firenze: Filza 9, car. 349. Lettera pubblicata dal ch. paleografo professore Gaetano Milanesi nel Giornale romano il *Buonarroti* quaderno IV, aprile 1869." Gualandi, *Atti e memorie*, 59, 74.

Discussion (b): In addition to the Gualandi transcription copied below, the letter is also transcribed, less completely and with the same reference provided by Gualandi, in Luca Beltrami, *Vita di Aristotile da Bologna* (Bologna: Libreria Luigi Beltrami, 1912): 39-40.

Al nome di dio a di primo di febraro 1458.

Magnifico mio magiore. Maistro Pagno *tagliapreda di Firenze me ha fatto a questi dì ambasciada per parte de la V. M. che voglia venire insin a voi per caxone di un campanile, el quale vorresti movere alquanto del luogho ove egli è fondato, offerendomi, che portandolo overo conducendolo io segondo la vostra intenzion a tutte mie spexe, mi serà dato mille fiorin d'oro. A la quale respondendo, ve dico, che non savendo di che qualità sia il terren del fondamento del detto campanile, e circonstante e contiguo a quello, ma vi faria sopra zò recisa risposta. Ben me conforto per quello ch' io posso comprendere, che 'l terren sia bon. Ma non me ne volendo però fidare, so non avuta experientia vi concludo che io son contento trasferirmi insin là a cavare, onde avesse a fare transito el pexo a condurlo e tastare et vedere el fondamento, el quale trovando bon, segondo che è veresimile, è mia oppenion da mo vi dico, che realmente io vi servirò, benchè el pesso sia smisurato, e la cosa difficillima, et per lo prexio di fiorini mille d' oro a tutte mie spexe, come m' è stato ditto. El quale premio non è però da farne guadagno, o pochissimo considerato le spexe grande e di cavamenti e d' altre molte occorrentie a sì stupenda imprexa. Ma per farmi noto in quella città e captare in quella qualche gratia, e masimamente da la magnifica Casa vostra, sarò contento intraprendere tale impresa. Maysì, che al venire a cognoscere se 'l terren è apto a zò, voglio come è iusto, venire, essendo satisfato del tempo che io gli* *ocuparò da partida di qui a la mia tornata, e così delle spexe del vive (re) e del cavare che serà necessario per venire a detta noticia.*

Altro per ora non mi pare havere a dire su questa materia, attendendo per vostra lettera la vostra deliberatione. E raccomandandomi sempre alla prefata V. M.

Bononie a dì primo de febraro 1458.

Vostro servitore Aristotile *di* Fioravanti.

(*fuori) Magnifico viro Iohanni*
Cosme de Medicis maiori honorando
Florentie.

DOCUMENT 1461a

1461 **July (see Beck, p. 215):** ***Ricordo*** **noting that throughout the month of July, 1461, the original high altar of the basilica was under construction.** [ASL 2192, *Entrata e Uscita et Ricordi e Partiti, 1456–1462, c.21v*; from *Donatello e la Sagrestia Vecchia*, 1986, p. 103.]

Discussion (a): The altar was substantially changed in 1499, and several times thereafter. The present design dates to 1787. Fragments of this document have been published at least three times. The following is from Saalman (1993, pp. 165–166).

...per tutto il mese di luglio si murò l-altare magiore n[os]tro...

Discussion (b): The following is from Beck (1984, p. 218, n. 11):

Per tutto dì primo d'agosto 1461 fu murato interamente il tabernacolo del Corpo di Cristo.

Discussion (c): Finally, the following is from Moreni (I, 1816, p. 15 n.1):

Per tutto il mese di Luglio 1461. si murò l'Altar maggiore nostro ec. Per tutto dì primo d' Agosto 1461. fu murato interamente il Tabernacolo del Corpo di Cristo.

DOCUMENT 1461b

1461 **August 1 (see Beck, p. 215):** ***Ricordo*** **noting that for the entire day, August 1, 1461, the high altar tabernacle was installed atop the altar.** [Biblioteca Laurenziana, ASL, No. 2192 (Entrata e Uscita, 1456-1462), fol. 21 v, from Beck, 1984, p. 215, n. 2.]

Discussion: The tabernacle was probably placed on a low wall behind the altar itself, thus allowing the "celebrant to say the Mass facing the congregation (see Lavin, 1993, p. 13f).

...per tutto dì di primo d'agosto 1461 fu murato interamente il tabernacolo del Corpo di Cristo.

DOCUMENT 1461c

1461 **August 9 (see Beck, p. 215):** ***Ricordo*** **describing the solemn procession in which the sacred relics of S. Marco Papa, S. Concordia Martire, S. Amato Abate, and S. Lorenzo are transferred from the high altar of the old San Lorenzo to the high altar of the new, and the consecration of the new church by the archibishop of Florence, Orlando Bonarli.** [Biblioteca Laurenziana, ASL, No. 2192 (Entrata e Uscita, 1456-1462), fol. 21 v, from: *Donatello e la Sagrestia Vecchia*, 1986, p. 104; also quoted in Beck, 1984, p. 215 n 3.]

...domenica a dì 9. d-agosto 1461 fu consecrato detto altare magiore p[e]r mano di mess. orlando bonarlj egregio dottore et arcivescovo di firenze e co[n] grande solemnità...col capitulo della metropolitana ecclesia et altrj preti i[n]vitati, colloca[m]mo i[n] detto altare tre corpi s[anc]ti cioè san marco p[a]p[a], s[anc]ta concordia martire e s[anct]o amato abbate et una capsetta plumbra bassa con reliq[uie] di san lore[n]zo, la quale è in un-altra capsa plumbra magiore nella quale sono bossoli dodici di legno quasi consunti p[er] la vetustà, ne quali è polvere solamente senza altre scritture. la detta capsa grande e la piccola entrovi con 12 bossoli detti trova[m]mo nell-altare magiore della chiesa vecchia.
la detta co[n]sec[r]atione rogò m. lotto di m. fracischo masi....

DOCUMENT 1461d

1461 **August 12. Record of the formal assignment of apartments, located in the cloister, to fourteen resident chaplains of the church.** [*Archivio del Capitolo di San Lorenzo, Entrata uscita e ricordi e partiti (1456–1462), No. 2192, C. 21v,* from Roselli and Superchi, 1980, p. 128; also quoted in Moreni, I, 1816, p. 14, n. 3.]

Questo di 12 dagosto congregato il capitulo come consueto si consegno, concesse, e largi camere 14 nuove fatte per cosmo demedici a 14 cappellani titulati inchiesa nostra sopra quattordici cappelle dettonsi liberamente senza alcun prezzo.…

DOCUMENT 1461e

1461 **September 19. Three more apartments in the cloister are assigned to chaplains, not yet in residence.** [*Archivio del Capitolo di San Lorenzo, Entrata uscita e ricordi e partiti (1456–1462), No. 2192, C.* 21v, from Roselli and Superchi, 1980, p. 128.]

Questo di 19 disettembre 1461 congregato il capitulo prestamo per gratia et amore tre camere a tre cappellani che non fanno ancora residenzia.…

DOCUMENT 1461f

1461 **November 8. The death of Antonio di Manetto Ciaccheri is noted in a deliberation of February 20, 1461 (new style), of the Consoli dell'Opera di Santa Maria del Fiore.** [*ASF. Arte della Lana, Provisioni e Riformaz. Libro Segreto I. 1450-1467 v. 53 a c. 142*; from Borsi, et. al., 1979, p. 275.]

...vacat offitio capudmagistrj Cupole et Lanterne dicte ecclesie per mortem Antonij Manetti, olim capudmagistrj dicte Operis defuncti jam pluribus mensis elapsis 8 novembri olim electi et deputati per dictam artem a pluribus et pluribus annis...

DOCUMENT 1462a

1462 **July 31. Records of payment for work undertaken at the basilica of Santa Maria del Fiore, Cappella della Nuntiata, for Piero dei Medici, by *scarpellatore* Iacopo di Nencio and *lastraiuolo* Bernardo del Proconsolo, the value of which was assessed by Pagno di Lapo Portigiani, who is mentioned as *capomaestro* at San Lorenzo.** [A.S.F., Conventi soppressi n. 119, vol. 844 *Libro di fabbrica*, 1461-1463, from Casalini, 1971, p. 32 n. 13, and p. 29 n. 7.]

f. 34r "'*Bernardo lastraiuolo al Proconsolo… de avere a dí 16 d'aprile* [1462] … *per una lapide di marmo bianco, tolse de l'opera di Sancta Maria del Fiore per fare l'epitaffio quando fu consegrata la capella della Nuntiata* [dal Cardinale Guglielmo

Estouteville, il 25 25 dicembre del 1452], *di volontà di Piero di Cosimo; posto al presente el detto marmo sotto la finestra dell'organo della capella*.' La lapide è ancora in loco."

f. 50v "*Iacopo di Nencio scarpellatore e compagni deono avere, a dí 31 di luglio per opere 65,1/3, lib. cinquantatre, s. 13, d. 6 a diversi priegi fecie maestro Pagno, capo maestro a San Lorenzo, di Cosimo; …feciono l'uscia del marmo per la capella della Nuntiata di volontà di Piero di Cosimo; commesse detto lavorio a maestro Bernardo del Proconsolo per ornamento di detta capella*."

DOCUMENT 1463a

1463 **No month cited. *Sepoltuario* for the church of San Lorenzo describing the locations of many tombs, apparently only in the underchurch.** [*Archivio Capitolare di S. Lorenzo, Doc. Var. 2214, fol. 1r-2r, and 14v*; Excerpts below are taken from Roselli and Superichi, 1980, pp. 129-130, with additional excerpts from Elam (1979) and Pudelko (1936), as noted.]

Discussion (a): <u>The document:</u> From the information provided in the following excerpts, the length, authorship, and chronological span of this document are difficult to determine. Elam refers to the document as "the *Sepultuario* (sic.) of 1463" (Elam, 1979, pp. 174 n. 23, and p. 185 Doc. G) while Clearfield describes it as a *sepoltuario* spanning from 1463 to "after 1482" (Clearfield, 1981, pp. 21, 22 n. 33, 24, 28). Clearfield attributes the document to Prior Pietro Bonichi (Clearfield, 1981, p. 21), although the author of the document identifies himself as *prete piero priore di San Lorenzo* (see below, C. 1r).

Discussion (b): <u>Ginori Corridor:</u> Since this document describes the Ginori corridor in use as a bural chapel, it provides a *terminus ante quem* of 1463 for the completion of the corridor. The corridor, a small and apparently simple appendage to the north transept, opposite the door to the Old Sacristy, appears in an early floor plan ("Documents" Fig. 32; cf. Burns, 1979 and Elam, 1979, p. 174, n. 23). While much of this *sepoltuario* refers to the underchurch (*delle sepolture nuove ha fatto Cosmo de Medici e glialtri di sotto la chiesa*), the reference to "a sepulcher between one door and the other" (*una sepultura fra luna porta e laltra*) within the Ginori corridor indicates that parts of it refer to the basilica proper.

Discussion (c): <u>*Tre porti*:</u> Gino di Giuliano Ginori's commitment to build "three doors" (*tre porti*), repeated in this and numerous other documents from 1451 to 1495, probably refers, as suggested by Elam, to three of the four door surrounds that adorned the two portals of the Ginori Corridor, the fourth being the *pietra serena* surround that forms part of the interior, Brunelleschi-designed fabric of the basilica (for transcriptions of all relevant documents and extensive discussion, see:Elam, 1979, pp. 162, 183-185). Saalman alternatively proposes that two of the doors in question were located at either end of the Ginori corridor, and that the third was the northern side door of the nave (Saalman, pp. 195-198). Saalman's proposal, however, rests on inconclusive documentary evidence, a possibly flawed estimate of the location of the old campanile (see "Documents," p.), and the reading of two indeterminate masonry patches flanking the northern side door in question as vestiges of Ginori coats of arms (see: Saalman, 1993, p. 197, Pl. 132).

Discussion (d): <u>Giovanni di Bicci de' Medici</u>: This document provides confirmation of Manetti's claim that Giovanni di Bicci de' Medici constructed both the Old Sacristy and the adjacent double chapel simultaneously.

Discussion (e): <u>*Pilastri cinque*</u>: From the fragmentary excerpts available, it is difficult to determine which, if any, of the several references in this document to *pilastri* refer to the columns or pilasters of the basilica proper, rather than to supporting piers in the underchurch. The word *pilastro* in fifteenth century usage could refer to piers, pilasters, or columns (see for example Docs. 1420a, 1434c, 1442h, 1443b, 1446f, and 1454a). One excerpt (C. 14*v*) distinguishes between a "large pilaster that supports the cupola" (*pilastro grande della cupola*), and a "pilaster that supports the vault" (*pilastro che sostiene lavolta*), thus suggesting that the document refers to the upper church, since from the vantage point of the underchurch it would be difficult to determine which piers support the cupola. The passage goes on to refer to the campanile, another feature that would seem to be difficult to recognize from the underchurch. The passage then notes that the spaces "from pilaster to pilaster" are three in number, and that the "two rows are five" (*tra pilastro e pilastro sono 3 il ij filare sono 5*). If the word *pilastro* in this passage is translated as "column," then the passage might be interpreted as a description of the nave of the basilica being composed of three spaces—a central nave plus two side aisles—and containing five columns per "row," or, per arcade, a condition that must have temporarily existed before the final two columns in each seven-column arcade had been erected.

Alternatively, if the two rows of five *pilastri* noted above refer to the rows of piers in the underchurch that run east-west, in alignment with the side walls of the high altar chapel, then the document may indicate that by 1463, *no* new nave columns had yet been erected since Cosimo de' Medici erected the first six in the 1440s. A pre-1700 floor plan of the underchurch (see: Roselli and Superchi, 1980, p. 79, Fig. 20) shows that, if we count piers starting from the east end of the south high altar chapel wall, and proceed east, the first pier is located mid-way across the transept, the second one is located beneath the crossing pier (see Crossing Pilaster 2), and the third, fourth, and fifth are located beneath Columns 7, 6, and 5. The latter three columns are three of the six columns erected by Cosimo (the others being Columns 8, 9, 10).

C. 1r

Qui di sotto come segue farò ricordo e scriptura io prete piero priore di San Lorenzo dellordine e forma delle sepolture nuove ha fatto Cosmo de Medici e glialtri di sotto la chiesa, et ad chi allogheremo dette sepulture, e in che luogo eparte accio si possino ritrovare prima. Cominciando dalla cappella maggiore et quella dallato della mano dextra inverso la Sagrestia, e dipoi dalla mano sinistra diverso Borgho la noce: et delle teste della croce et dallato di dette, cioè delli operai et di Marcho di Luca. Et seguendo di poi ad piè gli scaglioni di dette cappelle, le sepolture della Croce di detta Chiesa, <u>che disotto per rispetto de pilastri cinque che sostenghono le volte fanno dua nave</u>, o vero anditi, nequali anditi fra scaglione et scaglioni di cappelle sono quattro filari di sepulture nel piano di decta nave, andando perlolungho donde sentra di sotto la cappelle de medici alato alla Sagrestia perla scala del chiostro in decto cimitero et sepulture et seguendo infino alla testa et cappella della Croce di detta nave inverso Borgho la noce chel primo filare ad pie la cappella maggiore et laltre dallato per infino a hora murate fanno sepulture xxvj; dalla Sagrestia infino alla cappella della stupha cioè sepolture….xxvj

C. 1v

Terzo e quarto filare di dette sepolture nel secondo andito di detta nave allato asopradetti filari et allato alla nave maggiore, et dallato dipoi entrando in dette navi volendo seguitare per lo lungo della chiesa inverso la piazza come ne luoghi lhoro ne faremo menzione….

Alla Cappella della Croce allato alla Sagrestia et coniuncta adessa, che è di Giovanni di Averardo de' Medici, la quale murò insieme con detta

C.2r

Sacrestia, et de' suoi non nè per insino al dì doggi sepultura nessuna per che ne lentrata di sotto, et la scala che mette per il Chiostro in detto Cimitero, et a dette Sepolture….

[Next four paragraphs from Elam, 1979, p. 185, Doc. G, including bracketed comments:]

Alla famiglia e casa della stufa dua sepulture nella cappella di detta stufa fatta per andrea di lotteringho di m.ugho della stufa allato e da mano sinistra della cappella maggiore inverso la porta de Ginoli che mette di verso Borgo la Noce.

Alla famiglia et casa de Ciai et loro discendenti una sepultura nella cappella di detti et detta famiglia allato alla sopradetta cappella della Stufa et alla porta de ginoli che mette diverso Borgho la noce.

Alla Famiglia et casa de Ginoli una sepultura fra luna porta e laltra de Ginoli che mette diverso borgho la noce et allato et in mezzo tralla cappella dei Ciai et quella della croce di san Lorenzo: che se murato per insino ad hora per Ginoli.

Alla cappella della croce diverso Borgho la noce et allato alla porta de Ginoli in titolo di san Lorenzo che per sino a hora se murata per li Ginoli [next sentence overwritten in a 17th. century hand thus:] nota che questa sepultura e quella che oggi e dentro alla porta del fianco tra la cappella di marco di luca et la Cappella de' Medici.

[Return to Roselli/Superchi:]
C. 14v

Qui dappresso come segue porremo le sepolture che sono nella 2a parte della nave del mezzo inverso borgo lanoce et lastufa incominciando fuori della nave della croce dalpilastro grande della cupola inverso come siè detto borgo lanoce et tral pilastro che sostiene lavolta et divide dove è il campanile che per traverso tra pilastro e pilastro sono 3 il ij filare sono 5.

[Next paragraph from Pudelko, 1936, p. 60 n. 2; This excerpt in Pudelko is also partially quoted in Elam, 1992, p. 166 n. 42]

Alle tre famiglie e case e loro discendenti cioè Aldobrandini, Martelli et Antonio di Taddeo, nella cappella dell'Operai allato alla sopradetta Capella della Croce et allato et intesta della nave dallato il chiostro à riscontro e dirimpetto alla Cappella di S. Niccolò di Ginori tre sepolture per le sopradette famiglia finite per in fine adhora.

DOCUMENT 1463b

1463 April 6: Various payments are recorded, beginning on this date, by members of five different families for construction of the south nave chapels as a joint project.
[Capitolo di San Lorenzo, *Entrata e uscita di spese fatte per la fabbrica delle cappelle del Ginori—Cambini—Neroni et altre e della muraglia dell'alb*o *della corona*, from Roselli and Superchi, 1980, pp. 104-124.]

Discussion: The following excerpts identify the construction dates for the nave chapels of the Aldobrandini, Taddei, Cambini, Neroni, and Maringnoli families. Several of the entries note the location of the chapels in question as being "on the side of the church opposite the chiostro"—i.e., along the south side of the nave. (For more specific locations of individual family chapels in the south side of the nave, see Doc. 1653a.) One entry (C.37r) refers to these nave chapels collectively, as one unified construction project. Another (C.35r) notes the purchase of wood from the "opera of Santa Maria del Fiore," perhaps because the *capomaestro* of San Lorenzo at the time, Pagno di Lapo Portigiani, was also overseeing work at the cathedral (see Doc. 1462a). In the reference to work on the foundations of the basilica for Cosimo de' Medici (C.38r), it is not clear whether one or more of the south nave chapels is intended, or other parts of the church.

C.1r — MCCCliij
...E più anchora in detto libro chonto de denari ricevuto delle cappelle di nuovo simurono dallato dapiù e diversi cittadini e vari poplani in detta chiesa per chommessione e piacimento del venerabile chosimo de Medici edidetti cittadini

incominciono adi 6 daprile 1463 scripti indetto libro da c.32 inanzi e anchora achi paghero detti denari per dette cappelle. [p. 104]

C.34v — MCCCLXIIJ
…Giusto dantonio dichele echompagni scarpellatori dasettignano deono dare adi 9 daprile ff venti larghi sono per parte dipiu chappelle anno tolto afare insomma nellachiesa diS.to lorenzo difirenze dallato inverso alchiostro atutto loro maestero emateria diconchi etutto altro lavorio perlire 739 e soldi diciannove chechosi dettono lascripta ricevette detti denari inquesto c. 33 ec. 34 per francesco cambini eantonio di taddeo

Edeondare adi 16 daprile ff. dieci larghi ricevette dame perparte inquesto posto giovanni daldobrandino efratelli debitori perparte dellaloro cappella c. 36 [p. 110]

C.35r
Eadi 21 didetto ff. tre larghi ricevettero dal muramento inq° dal c. 39 per chomprare legname per tetti dallopera disanta maria del fiore [p. 111]

C.39v — MCCCLxiij
Zanobi diluca bazzani scarpellatore e matthia suofratello cheanno condotto affare ditutta lacappella demarignolli deono fare giusto dantonio dichele ecompagni deono dare adi 20 dottobre ff. dieci larghi eperloro detti agiusto dantonio dichele ecompagni ricevettono dal muramento dellacappella inq° c 39 [p. 113]

C.37r — MCCCLxiij
Cappelle emuramento dichappelle simurano dapiu cittadini delnostro popolo inverso edallaparte delchiostro inverso alchiostro echiuse daparti deono avere ff. trenta larghi paghorono induo partite infino adi 16 daprile agiusto dimichele maestro di scarpello echompagni dasettignano per parte disomma didette chappelle anno tolto affare eogni loro spesa inq° c.35 [p. 121]

C.38r — MCCCLxiij
Dietisalvi dinerone deavere adi 24 daghosto ff. trenta larghi recho zanobi suofigliuolo perparte delmuramento dellasua chappella posto almuramento dellacappella inq° c. 37 debbino dare [p. 122]
…
Edeavere adi 21 dimarzo lire diciotto soldi diciotto permoggio sei dichalcina avuta dallui perfondamenti della chiesa di santo lorenzo per chosimo de medici chome appare allibro rosso didetta muraglia a. c. 131 posto rechare edabitare perrisochontro per mano digiuliano di simone cassiere

Document 1464: Cosimo’s death: 1 August, 1464 [What document to use?].

DOCUMENT 1464a

1464 **October 9. Excerpt from the will of Orlando di Giovanni d' Orlandini which provides for the maintenance of an image of the Virgin Mary and a lamp afixed to the second to last column of the north arcade.** [Moreni, I, 1816, p. 133 n. 1; also quoted in]

Discussion (a): This document would seem to indicate that the north arcade is complete by October 9, 1464. [revise]

Reliquit amore Dei, et pro utilitate anime sue Ecclesie, et Capitulo Ecclesie S. Laurentii de Florentia dimidium urcei olei, hoc est, medietatem unius barilis, sive lagene olei quolibet et pro quolibet anno in perpetuum cum onere, quod Prior, et Capitulum dicte Ecclesie teneantur, et debeant continuo tenere unam lampadem ad Oraculum, et ante Figuram Virginis Marie pictam, et sitam in secunda columna a *dextris in introitu dicte Ecclesie, sive in columna, que est in dicta Ecclesia, propinquiori, et prope januam, per quam egreditur et itur recta linea in viam Stuphe, que lampas debeat continuo cum oleo retineri accensa: in hoc conscientiam Prioris, et dicti Capituli strictissime onerando ec.*

Discussion (b): In a document dated August 3, 1501, the same Orlando makes another provision for this image, this time called "Our Lady of the Column" and now located "...in the first chapel next to the porta Ambrosiana on the north side." Moreni's description and quotation of this document is as follows [from: Moreni, *ibid*.]:

"Nello Specchio degli Obblighi del 1501. pag. 8 ciò si ripete dicendosi, che il medesimo lasciò, oltre un Uffizio da farsi in perpetuo ai 3. Agosto `un mezzo orcio d'olio per la lampana della Figura di nostra Donna del Pilastro, oggidì nella prima Cappella appresso alla porta Ambrosiana verso Tramontana.'"

DOCUMENT 1465a

1465 **April 24. *Ricordo* noting the concession by the prior and canons of the church of San Lorenzo to Piero de' Medici the authority to assign patronage of the northern nave chapels, which the document notes, "still have to be built" (*che di nuovo s'hanno a murare*), to anyone of his choosing. The stated purpose of this concession is to expedite the construction of the chapels (*dare expeditione et plentitudine alle cappelle*.** [*Archivio del Capitolo, Libro dei Ricordi, acc. I e 4, fasc. 3, a cc. 15 e 55*, from Ginori Conti, 1940, pp. 72–73.]

Discussion (a): This document states that while the chapels along the southern side of the nave had been completed by April 1465, the northern chapels "were not yet completely finished" (*non sono interamente fornite*), probably due to a lack of patrons. The prior and canons, evidently alarmed by this construction delay, perhaps reluctantly agreed to give up their right to dispense patronage to the chapels in the hopes that Piero could use his influence to find the necessary patrons, and convince them to begin construction quickly (see Doc. 1446a).

Discussion (b): This document also grants Piero the right to give "expedition and plentitude to the chapels that at present are built on the side [of the church] near the chiostro [i.e., the south nave chapels] that as yet are not completely furnished." Perhaps this latter provision is in reference to the Medici chapel (between SP 3 and SP 4) that perhaps had been built with Medici funding but not yet assigned to a family for patronage.

Discussion (c): By indicating that substantial construction work remained after Cosimo's death, this document lends credibility to Vespasiano's account, which notes that Cosimo "he hegan to build the church, and finished a large part of it before he died," (*cominciò a seguitare la chiesa, e fenne una buona parte inanzi che morissi*; Vespasiano da Bisticci, p. 182).

...concessono e diedero piena autorità al magnifico uomo Piero di Cosimo de' Medici d'allogare a qualunque ciptadino, che a lui parrà, tutte le cappelle che di nuovo s'hanno a murare nella parte della chiesa verso la tramontana, cioè inverso il casamento dellla Stufa et di quelle [dargli] *ogni sicurità appartenente al muramento d'esse et ad ogni altro ornato come e' paramenti et libri: et sì gli concessero* [l']*autorità e balià, ch'è usata pel nostro Capitolo, di dare expeditione et plentitudine alle cappelle che al presente sono murate dalla parte del chiostro, a rincontro delle sopraddette che ancora non sono interamente fornite.*

DOCUMENT 1465b

1465 **September 11. Codicil of Benedetto di Antonio di Giovenco de' Medici directing his descendants to build a chapel in honor of S. Bernardo in the nave of the new San Lorenzo, to be like the others in design, and located on the site of the old campanile, which had not yet been demolished.** [Moreni, I, 1816, p. 117 n. 1, reference not provided. Roselli and Superchi, 1980, p. 128, describe this document, and provide the following reference: “Biblioteca Medicea Laurenziana, Archivio del Capitolo di San Lorenzo, Pergamene, Fondo della Basilica di S. Lorenzo, 1465 Settembre 11, Firenze No. 1104.”]

Discussion (a): The chapel in question is located between Step Pilasters 67 and 68. The campanile was probably not demolished until 1481 (Doc. 1481a), and this chapel was presumably built soon thereafter.

Pro remedio anime reliquit, et logavit, quod per ejus heredes in dicto testamento institutos, construatur, et hedificetur, et construi, et hedificari fiat in Ecclesia S. Laurentii de Florentia, et in loco, ubi de presenti est Campanile, qui locus dixit, quod sibi consignatus fuit per Priorem, et Capitulum dicte Ecclesie, et aliis, qui sibi consignare poterant expensis sue hereditatis, una Cappella cum Altari sub titulo S. Bernardi, quando, et cum primum murabuntur, et construentur, seu similibus expensis, et ornamentis, et aliis, cum quibus, et prout murabuntur, et construentur alie Cappelle in dicte Ecclesia, et cum eadem, seu similia expensa, et costo sicut alii exponent, qui similes Cappellas in ipso loco hedificabunt. Et sic dicti ejus heredes instituti solvere, et pagare teneantur, et debeant omnes expensas pro construendo, et edificando dictam Cappellam, et Altare, et tantum quantum alii pro similibus cappellis expendunt de bonis hereditatis ipsius Codicillatoris.

Discussion (b): Attached to the above codicil is part of the testament of Antonio di Bernardo di Antonio Medici dated July 8, 1479 (or July 8, 1475, according to Roselli and Superchi, 1980, p. 128), which further provides for the endowment and maintenance of the yet-to-be-built chapel (from Moreni, I, 1816, p. 117 n. 1).

Item reliquit, quod infrascripti sui heredes teneantur, et debeant emere tot bona immobilia, que ascendant ad summam Florenorum centum de S. (Sigillo) et dicta bona sint, et esse debeant Cappelle S. Bernardi site in Ecclesia S. Laurentii de Florentia. Et quod Cappellanus dicte Cappelle in perpetuum teneatur, et debeat quolibet anno facere, aut fieri facere unum Annuale, sive officium pro remedio anime testatoris, in quo expendat Florenos quinque de Sigillo.

Discussion (c): According to Moreni, this chapel was originally dedicated to S. Bernardo, but by his time had become commonly associated with S. Anna, “owing to the popular devotion toward this saint” (Moreni, I, 1816, p. 117-118). Later, Fra Bartolommeo painted a preparatory panel in chiaroscuro in this chapel, but the work remained unfinished at his death. In 1690 the panel was ordered placed in the Sala del Consiglio by Piero Soderini. This document decribes the chapel as located next to the northern side door of the nave. Combined with the preceding comments by Moreni, it thus provides further confirmation that this Medici chapel was built on the site of the old campanile [from: Moreni, I, p. 118, n. 1].

Illustrissimo Signore

Pensando il Serenissimo Padrone di cavare da codesta sua Chiesa la Tavola di S. Anna, dipinta a chiaroscuro dal Frate [Bartolommeo], che è nella Cappella de'Medici accanto alla porta del fianco, per trasferirla quì in Palazzo, mi comanda S. A. S. di darne questo cenno a V. S. Illustrissima, acciò ella si informata della sua mente, e sappia d'aver a permetterela suddetta estrazione, che sarà eseguita per mezzo del Sacerdote Gio. Guerrino Guerrini, il quale nell' istesso tempo farà collocare nella medesima Cappella un altro quadro recipiente, ed io in eseguire ciò, a VS. Illustrissima confermo la mia devota servitù.

Di Camera li 21 Agosto 1690.

Leopoldo Tomansi

Discussion (d): In 1760 a marble tablet was placed in this chapel by descendants of the Medici family branch that founded it, for the purpose, according to Moreni, of clarifying apparent confusion over the history of the chapel (see Moreni, I, 1816, pp. 120-121). The tablet clearly states that the old campanile stood on the site of this chapel. The text of the existing tablet follows (also quoted, with errors, in Moreni, *ibid*.):

MAGNIFICUS BERNARDUS MEDICES ANTONII FILIUS IUVENCI NEPOS ANNO MCCCCLXV HIC UBI CAMPANARIA VETUSTI TEMPLI TURRIS ADHUC ASSURGEBAT SPATIO SIBI IURE OPTIMO VINDICATO SACELLUM D BERNARDO DICATUM EXTRUENDUM ET CAPELLANIA AERE SUO AUGENDUM TESTAMENTO VOLUIT
EIUSQUE HÆREDES PERSOLUTO TANTI MAIORIS VOTO PENES SE SOLOS ET SACELLI DOMINUM ET SACERDOTII COLLATIONEM SARTA TECTA SEMPER CONSERVARUNT ERA DE RE FRANCISCUS ET PETRUS MEDICES AVERARDI FILII AC FUNDATORIS POSTERI MONUMENTUM POSUERE ANNO REPARATAE SALUTIS MDCCLX

DOCUMENT 1469a

1469 **No month cited. Excerpt from tax return of Gino Ginori noting Gino's obligation to build "three doors" in the church of San Lorenzo.** [ASF, Catasto 923, fol. 795r, from Elam, 1979, p. 185, Document H; also quoted in Ginori Conti, 1940, p. 258.]

Discussion: See Doc. 1457a.

Una casa atta a forno nella piazza di S. Lorenzo...la quale Antonio Ginori mio fratello obrigò a chapitolo e convento di Sa' llorenzo pe' lla muraglia di 3 porti di sa'llorenzo verso borgo la Noccie e piazza Madonna e quella va in chiesa...

DOCUMENT 1469b

1469 **September 18. Record of payment by Nicolò Dante Ughi for the construction of one chapel.** [Pergamene — Fondo della Basilica di S. Lorenzo, 1469, Settembre 18, Firenze, No 1049, as described by Roselli and Superichi, 1980, p. 128.]

Discussion: This document must be in reference to one of the four northeasternmost nave chapels, since all others had been either built or assigned by this time. The following passage appears to be in the words of Roselli and Superchi, describing but not quoting from this document (brackets are Roselli and Superchi's).

"Testamento di ser Antonio del fu Domenico di Nicolò Dante Ughi cittadino e notaio fiorentino del popolo si s. Maria del Fiore, il quale lega alla chiesa di S. Lorenzo la somma di 200 fiorini d'oro per l'erezione di una cappella [leggi 'cappellania'] e per la celebrazione di un certo numero di messe settimanali.
Rog.: Bartoloneus"

DOCUMENT 1470a

1470 **May 6. Description of a testament of Francesco del fu Ubaldino Inghirami providing for the reconstruction, at his expense, of a nave chapel which was damaged by work undertaken in the church.** [Pergamene — Fondo della Basilica di S. Lorenzo, 1470, Maggio 6, Firenze No. 1052, as described in Roselli and Superchi, p. 129.]

Discussion: The original dedication of the Inghirami Chapel appears to have been to San Lorenzo, and so the reconstruction appears to be of the Inghirami Chapel itself, located between Step Pilasters 70 and 71 (see Doc. 1653a). The following passage appears to be in the words of Roselli and Superchi, describing but not quoting from this document.

> "Testamento del nobiluomo Francesco del fu Ubaldino Inghirami, il quale tra le altre cose, dispone che venga riedificata a sue spese la cappella di S. Lorenzo, nella chiesa omonima, danneggiata dai lavori eseguiti nella chiesa.
> Rog.: Andreas olim ser Angeli de Terranova, iudex et notarius."

DOCUMENT 1475a

1475 See Document 1479a

Discussion: Scholarly descriptions of the codicil contained in Document 1479a are inconsistent: Moreni, *Continuazione*, vol. 1, 117 note 1, provides a date for the codicil of 8 July, 1479; while Roselli and Superchi, *L'edificazione*, 128, provide a date for the codicil of 8 July, 1475.

DOCUMENT 1477a

1477 Lorenzo de' Medici is given permission to log the woods belonging to the Opera del Duomo for the roofs of San Lorenzo. [from Elam via Peggy Haines]

DOCUMENT 1479a

1479 (1475?) July 8. Clause added to the Codicil of Benedetto di Antonio di Giovenco de' Medici providing for the endowment of an as yet unbuilt chapel, dedicated to S. Bernardo, in the north side of the nave [from: Moreni, I, 1816, p. 117 n. 1, reference not provided; Roselli and Superchi (1980, p. 128) provide the following reference for this document: "Biblioteca Medicea Laurenziana, Archivio del Capitolo di San Lorenzo, Pergamene, Fondo della Basilica di S. Lorenzo, 1465 Settembre, Firenze No. 1104, 1475, Luglio 8"].

Discussion: Evidently this chapel, located between SP 67 and SP 68, had not yet been built because the old campanile on the site (see Doc. 1465b) had not yet been demolished. Note that Roselli and Superchi, who describe the document but do not quote from it, provide a date of July 8, 1475, while Moreni provides July 8, 1479. The correct date is unknown. The following is Moreni's discussion and quotation of this document:

> "Entro la copia di questo Codicillo evvi ancora il sunto del testameuto [sic.] di Antonio di Bernardo di Antonio Medici dell'anno 1479 del dì 8. di Luglio, dove si legge: [']*Item reliquit, quod infrascripti sui heredes teneantur, et debeant emere tot bona immobilia, que ascendant ad summam Florenorum centum de S. (Sigillo) et dicta bona sint, et esse debeant Cappelle S. Bernardi site in Ecclesia S. Laurentii de Florentia. Et quod Cappellanus dicte Cappelle in perpetuum teneatur, et debeat quolibet anno facere, aut fieri facere unum Annuale, sive officium pro remedio anime testatoris, in quo expendat Florenos quinque de Sigillo.*[']"

DOCUMENT 1480a

1480 No month cited. Excerpt from tax return of Gino Ginori noting that "three doors" have been partialy built in the church of San Lorenzo, but that 300 florins have yet to be spent to finish the work. [*ASF, Catasto 1016, fol. 170*, from Elam, 1979, p. 185, Document J].

Discussion: See Doc. 1457a.

O a murare tre porti di sa'llorenzo vanno alla via di Borgho della noccie sonne murate parti; ovvi a spendere a fornirlle fl. 300 piu per testamento mi fu lasciato Roghato Ser Antonio Danti.

DOCUMENT 1481a

1481 **June 20. Record of payment for repair work and removal of rubble possibly associated with the demolition of the old campanile.** [*ASCL* 1929[3], c. 72v, from Saalman, 1993, p. 439, Documents 12.1 and 12.2, brackets are Saalman's.]

Discussion: The work described in this document, including repairs to the roof and masonry work to fill "holes in the pavement that go under [next to?] the church," combined with a reference to "the roof of the bells," suggests that cleanup and repair is underway following demolition of the campanile. Nevertheless, the document is sufficiently ambiguous to preclude any definitive association of it with the old campanile, such as that proposed by Saalman (*ibid*.). In an earlier work, in support of his belief that the campanile was demolished in the period 1480-84, Saalman provides the following reference: ASCL 1930[2] (1481–82), c. 72–74v, but does not quote from it (Saalman, 1985, p. 203).

Domenico [di Nanni del Corno di San Marco] *s. tredicij furono per rimenatura del tetto della chiesa in piu luoghi el tetto delle champane e spazzare sotto la chiesa e rimurare le buche di sulla piazza che va sotto la chiesa... S.13*

Transcribed again by Jack Wasserman in July 2010 as follows:

Domenico s. tredicj furono per rimanere del tetto della chiesa in piu' luoghi el tetto delle champane... S.13

DOCUMENT 1484a

1484 **March 10 (new style). Record of payment for 700 bricks to be used in the vicinity of the northern side door in the nave.** [*ACSL* 1930[3], c. 74, from Saalman, 1993, p. 439, Document 13.1, brackets are Saalman's.]

Discussion: The word "bricks" (*mattoni*) as used here likely refers not to fired bricks, but to pieces of cut ashlar for use in the exterior revetment (see Doc. 1484c). Saalman, conversely, interprets this document to be a description of work related to construction of the "Porta de' Ginori," which he believes to be the northern side door, a hypothesis that I believe he has not convincingly argued (Saalman, 1993, pp. 195-198, and 439; For more on the question of the "Ginori doors," see discussion, Doc. 1457e).

...per insino a dj x di marzo 1483 per 7 cento mattonj per murare in sul chanto della porta che va in chesa [sic.] *di sulla piazza.*
I. I S.—

DOCUMENT 1484b

1484 **May 28: Record of payment for pavement along the north wall and front of the basilica.** [*ACSL* 2464, c. 61v, from Saalman, p. 439, Document 14.1.]

Francesco di Piero Baccegli lastraiuolo deavere insino a questo di 28 di maggio 1484 l. centocinquanta soldi otto d. sej per braccia cinquecento quarantasette di lastrico fatto lungho la nostra piaza verso tramontano dirimpetto alle case delle Stufa di braccia ottantanove e mezo di lungheza e sei di largheza con una rivolta di verso levante di braccia dieci riquadrate dandogli s. cinque d. sei del braccia l. 150 s. 8 d. 8

DOCUMENT 1484c

1484 **October 14: Record of payment for stone revetment along the north wall of the basilica.** [*ACSL* 1930[3], c. 74, from Saalman, p. 439, Document 13.2.]

Discussion: Payment is made to Biagio del pescha is for the "dressing" (*acconcciare*) of two walls, one "along the hospital that looks onto the piazza," and the other near the porta de ginori." Although the exact locations of the walls in question is not clear from this description, the document seems to be referring to the entire north face of the basilica, including the continuous back wall of all the north nave chapels, the northeast corner of the chapel of Luca di Marco, and the two sides of the northern double chapel, not including the Ginori corridor. The "porta de ginori" probably led to this corridor, which was located on the present site of the New Sacristy (see "Documents Fig.). According to the preceding interpretation, the north face of the basilica technically consists of five wall segments, but perhaps for simplicity the document refers to the two longest ones, which are both north facing. In the following quotation, bracketed comments by Saalman have been omitted. Elam also transcribes slightly different selections from this document (which she dates October 15, 1484), but provides no reference (Elam, 1979, p. 185, Doc. K). On the location of the Ginori door mentioned in this document, see discussion, Doc. 1457e, and Saalman (1993, pp. 195-198), who I believe incorrectly interprets this document to be a reference to the construction of the northern side door of the nave, a door that he believes to be the "Porta de' Ginori" (see Doc. 1484a).

Adi 14 dottobre a Biagio del pescha fl. uno largho doro in oro per spendere in acconcciare due murj cioe lungho lospedale quello risguarda la piazza e quello della porta de ginori. Del quale spende l. due s. dodici in tre some di calcina. Et l. due s. diecj a franc[o] charettino e a uno suo compagno per carrettate ventidue di terreno si fe levare da detta porta e s. ventj a buonaiuto manovale per due opere a sterrare l.6 s.2…carrettate di terra l.2 s.I0…sterrare la piazuola…sterrare insomma terreno della piazuola de ginori detta a fare le schalee a secho…e per fare detto muro a secho inso adj 2 di giugno.

DOCUMENT 1485a

1485 **June 20. Discussion of plans for a new campanile.** [*ACSL* 2366, c. 15v, from Saalman, 1993, p. 440, Document 15.]

Adi 20 di luglio 1485 per partito vinto si concesse a Messer Giuliano di Bartolomeo nostro canonico quello andito che e allato alla camera sue chera riservato overo facto per andare in Campanile se qui ci facesse dicto campanile con questi pacti che se detto andito overo entrata bisognasse auso di dicto campanile overo ad alcuna necessita e commodo della casa per andare per quello luogo di sopra…e cosi sobbligo arenderlo in quella forma era quando gli fusse concesso.

DOCUMENT 1488a

1488 **November 15. Testament of Francesco di Piero di Francesco di ser Gino di Giovanni noting that the chapel in the church of San Lorenzo, dedicated to S. Jeronimi and S.**

Francisci and located between SP 71 and SP 72, was purchased from Piero de' Medici. [*Archivio di Stato di Firenze, rogiti di ser Angiolo di Cinozzi*, C. 525 anni 1442-1489, from Ginori Conti, 1940, pp. 274-275, brackets and emphasis are Ginori Conti's].

Discussion: Francesco endows the chapel with 500 florins, and specifies that it must always remain in the Ginori family. This document confirms that Document 1465a, in which the prior and canons concede to Piero de' Medici their authority to assign patronage to the northern nave chapels, was indeed put into effect (see also Ginori Conti, 1940, pp. 83-84).

> [c. 214ᵗ]: *Item jure institutionis reliquit cum infrascripto onere, gravedine et conditione, Tommasio, eiusdem testatoris filio legitimo et naturali, et dicti Tommasij filiis et descendentibus masculis legittimis et naturalibus in stirpem et non in capita, domum habitationis dicti testatoris positam Florentie, in populo Sancti Laurentij de Florentia, in via dicta Borgo S. Lorenzo, cui a pº, via, a ij Gini Juliani de Ginoris, a iij heredum Pierfrancisci Laurentij de Medicis, a iiij dicti testatoris, videlicet domus, in qua ad presens habitat dictus Ginus filius dicti testatoris; quam domum dictus testator existimat valoris florenorum duorum millium quingentorum de sigillo; et quam domum dictus testator reliquit dicto Tommasio cum infrascripto onere et gravedine, videlicet…….* [seguono alcune disposizioni circa pagamento di una indennità di fiorini cinquecento da farsi da detto Tommaso a Gino suo fratello e ai nipoti figli dell'altro fratello Leonardo quando avessero rinunziato al diritto di abitare in detta casa:]
> . . . .
> *Et ultra predicta dictus Thomasius teneatur dotare cappellam emptam per dictum Franciscum in ecclesia Sancti Laurentij de Florentia sub nomine Sancti Francisci et Jeronimi in quantitate florenorum quingentorum de sigillo et pro dicta quantitate florenorum quingentorum solvendorum pro dote dicte cappelle reliquit dictam domum magnam obligatam. Quam capellam voluit disposuit quod numquam possit alienari, sed sempre sit et remaneat sub nomine dicti Francisci Petri ser Gini de Ginoris et suorum descendentium. . . .*
> . . . .
> [c. 218ʳ] *Item in casu quo dictus testator dum viveret vel post eius mortem dicti filii nepotes ut supra heredes instituti vel aliquis ipsorum non dotarent dictam cappellam Sancti Jeronimi et Sancti Francisci positam in dicta ecclesia Sancti Laurentij emptam a Laurentio Petri de Medicis, tunc et eo casu post mortem dicti Francisci et dictorum suorum filiorum et nepotum heredum reliquit dicte cappelle pro eius dote unum predium dicti testatoris positum in populo Sancti Stefani de Sommaia cum omnibus suis pertinentiis, quod predium dixit fuisse emptum a domina Nanna uxore Lazeri Tolesini de Medicis nepote Juliani Thommasij Guccj.*

DOCUMENT 1507a

1507 **No month cited. Entry in an inventory of the basilica of San Lorenzo begun in 1507 describing a small panel of the Madonna located in the Ginori corridor (*androne*), thus indicating that the corridor has not yet been demolished to make way for the construction of the New Sacristy.** [*Archivio Capitolare di San Lorenzo*, 2634, fol. 15r. (16r mod. num.), after 1507, *Biblioteca Medicea Laurenziana*, Florence, from: Reiss, 1993, p. 342 and Fig. 4.]

> *Androne di ginoli* [*sic*]*: Una Tavoletta di n[ostr]a don[n]a con uno sciugatoio di braccia 3.1/2, una la[m]pana.*"

DOCUMENT 1516a

1516 **December 30. Letter from Bacio d'Agniolo to Michelangelo noting that new foundations must be built to support the projected new façade of the basilica of San**

Lorenzo, because he determined that the existing foundations on the site, which he believed to be of the old basilica of San Lorenzo were not suitable. [*Archivio Buonarroti, Florence, VI, n. 44, as transcribed in Paola Barocchi and Renzo Ristori, eds., Il carteggio di Michelangelo: Edizione postuma di Giovanni Poggi, 5 vols. (Florence: Sansoni Editore, 1965-1983): 1:236.*]

Carisimo mio Michelagniolo, dipoi ti partisti i' ò fato ricerchare molto quel fondamento e so'mi fato nel mezo. E in fato e' ci bisognia rifondare di nuovo, ché quelo che noi vedemo non era el fondamento buono. Ò trovato che era e' fondamento del porticho vechio, e chosì ò datto aviso a Domenicho Buoni[n]segni. Sì che dami aviso quelo vuoi ch'io faci, e tanto farò: se tu vòi ch'io rifondi o ch'io t'aspeti. Non altro. Idio ti ghuardi. A te mi rachoman[d]o.

Bacio d'Agniolo in Firenze

Domino *Michelagniolo Buonaroti a Charara*

DOCUMENT 1517a

1517 **January 5 (modern style). Letter from Domenico Boninsegni to Michelangelo making arrangements to build new foundations for the projected façade of the basilica of San Lorenzo, in light of Bacio d'Agniolo's letter noting that the then-existing foundations were not good (see Document 1516a).** [*Archivio Buonarroti, Florence, VI, n. 99, as transcribed in Paola Barocchi and Renzo Ristori, eds., Il carteggio di Michelangelo: Edizione postuma di Giovanni Poggi, 5 vols. (Florence: Sansoni Editore, 1965-1983): 1:238.*]

Carissimo Michelagnolo, io ebbi a questi dì la vostra di non so di che dì, ma era da Firenze, e vidi savate giunto e stato con Baccio d'Agnolo e restati d'acchordo. Dipoi ò da Firenze lettere, e vedo che Baccio scrive quel fundamento non buono e bisogna pensare al modo del fundare. El che tutto ò referito al patrone, e m'à ordinato che si scriva a Firenze che si metta mano a far li detti fundamenti chome prima si possa, a chausa che non s'abbi a ritardare al mandare l'opera avanti.

Intendo chome per essere arrivato a Firenze inelle feste, e non volendo voi aspettare, vi partisti sanza aver danari; ma ò aviso che dipoi Iacopo Salviati ve li à mandati drieto, che chosì ò referito al Chardinale. Sollecitate voi di chostà el bisogno delli marmi, a chausa non s'abbi a perdere tempo.

Al Chardinale ò detto di quel chonfessionale che vuole vostro padre, e m'à detto lo facci scrivere. E di già l'arei fatto: ma perché vi può esser compreso sino a XII persone, ne ò scripto a Buonarroto che mandi la nota insino in dodici, e alora lo farò scrivere e vi si manderà, cioè a Firenze, a vostro padre.

Né altro. Sono vostro. Christo vi ghuardi.

Domenico Boninsegni in Roma

Domino *Michelagnolo Buonarroti in Charrara*

DOCUMENT 1517b

1517 **January 7 (modern style). Letter from Bernardo Nicholini to Michelangelo discussing the need to build new foundations for the projected façade of the basilica of San Lorenzo, in light of Bacio d'Agniolo's letter noting that the then-existing foundations were not good (see Documents 1516a and 1517a). The planned fabrication of a model of the façade is also discussed.** [*Archivio Buonarroti, Florence, X, n. 569, as transcribed in Paola Barocchi and Renzo Ristori, eds., Il carteggio di Michelangelo: Edizione postuma di Giovanni Poggi, 5 vols. (Florence: Sansoni Editore, 1965-1983): 1:239.*]

Michelagniolo karissimo, io non v'o scripto dipoi la partita vostra, e nonn ò vostre. Baccio d'Agniolo vi scripse a la lettera è ritornata indrieto, ché dichono eri andato a Roma. Dovei esere a Pietrsanta o altrove. Pazienzia. Aretela chon questa. E il medesimo vi afermiamo che, faciendo noi chavare o seghuire di chavare a quello fondamento della facciata di Sam [sic] *Lorenzo, per qualche dubio che ci aveva Bacio, si trovò e truova che e' fondamenti non sono veri né buoni, e quello muro che vi si mostrava era il fondamento del porticho vechio; di modo che, samza a altro pensare,* onino *bisognia di nuovo rifondare, ché quelli non sono nulla. Favisi intendere a chautela, et el medesimo se n'è scripto a Roma. Saraci charo ci avisate di vostro animo, ché Bacio è d'animo non uscire di vostra volontà. Direte quello vi pare si faci, e in questo mezo ci fia lettere da Domenico e vedremo si facia quello che voi ci direte. Avisate subito di vostra intenzione.*

El modello si va faciendo e per anchora non siamo in ordine di dirvi che vegniate; quando sia, vi se ne darà notizia per doppie lettere. Bacio lo solecita, et voi non manchate di dire di vostro animo di questo fondamento, ché, chome è detto, quello è nulla e bisognia rifarlo ad ogni modo. Dite di vostro parere.

Ricievesti li duchati 1000 d'oro da li Salviati, secondo n'ànno detto, e fu in duchati larghi e buoni, per quello m'àno referito. Arò charo sieno stati a vostra sadisfazione.

Buonaroto mi dise ebbe li duchati 400 da' Lanfedino, che mi gli ero oferto per farne l'opera, e non bisognò. Vostro padre ò visto 2 giorni sono: va fuora a sta bene, Iddio grazia.

Rispondeteci. Christo vi di[a a] p[igliare lo meglio].

Bernardo Nicholini in Firenze.

Domino *Michelagniolo Buonaroti a Charara.*
Pagate di porto dua bolognini, cioè 2 bolognini.

DOCUMENT 1517c

1517 **January 8 (modern style). Letter from Bernardo Nicholini to Michelangelo discussing the need to build new foundations for the projected façade of the basilica of San Lorenzo, noting that the then-existing foundations were not good (see Documents 1516a, 1517a and 1517b).** [*Archivio Buonarroti, Florence, X, n. 570, as transcribed in Paola Barocchi and Renzo Ristori, eds., Il carteggio di Michelangelo: Edizione postuma di Giovanni Poggi, 5 vols. (Florence: Sansoni Editore, 1965-1983): 1:240.*]

Michelagniolo carissimo, scrisivi ieri per via di Lucha et vi disi delli fondamenti che bisognia rifare a la facciata di Sam Lorenzo, perché quelli che si trovavano erano li fondamenti del porticho vechio, e sono cattivi et tristi e non vagliano, di modo infalante bisognia rifondare. Così ne abiamo scripto a Roma. Avisate di vostro animo. El modello si solecita. Christo vi di[a a] p[igliare lo meglio].

Bernardo Nicholini in Firenze.

Domino *Michelagniolo Buonaroti in Charrara.*

DOCUMENT 1517d

1517 **July 8. Letter from Andrea di Piero Feruci to Michelangelo reporting on progress in constructing the new foundation for the projected new façade for the basilica of San Lorenzo, noting that some existing foundations uncovered during the work appear to be good and were left in place and reused, while others were removed and rebuilt. (see Documents 1516a, 1517a, 1517b and 1517c).** [*Archivio Buonarroti, Florence, VIII, n. 310, as transcribed in Paola Barocchi and Renzo Ristori, eds., Il carteggio di*

Michelangelo: Edizione postuma di Giovanni Poggi, 5 vols. (Florence: Sansoni Editore, 1965-1983): 1:292.]

Honorando mag[i]or mio Michellang[n]ollo, dopo lle debitte sallute ett cet. La pressente ssarà darvi avisso chome qui è statto Iachopo sSallviatti. Àmi inposto che io vi deba sschrivere per parte ssua chon dirvi chome voi vi ssforziatte di sspedire chostì quanto più presto megllio, inperò che ssi parte di qua Bacio d'Ang[n]ollo e Bacio Big[i]o llunedì che viene, che ssaremo a dì 12 di llugllio. E vengono a Prettasanta per ffare e ordinare questa via; e dicie chossì Iachopo sSallviati che volle che voi vvi siatte e che vi ffarà ssiqureza d'ongni quallunche chossa. Òvi sschritto circha di questo mallvollentieri, dubittando io non lo abiate per malle; ma ò ffatto perché chossi m'è statto inposto, chome di ssopra v'ò ditto.

Circha le chosse nostre de' ffondamento ssi fa, va chontinuando a pocho a pocho, perché ttroviamo di molti muri vechi che bissognia dissfarglli. E abiamo ttrovatto in ssull chanto della chiessa uno ffondamento ched ecie ffuori dell muro della chiessa circha di ttre bracia, e per dinanzi sseguitta anche bracia 4 o fforse 5; e questo e' ffu ffatto quando ssi fecie ell ffondamento della chiessa nuova, ed è chossa buona. Questo lo lasseremo stare e glli alltri glli ffo ttuti disfare, perché non mi pare che ssieno chossa da llassarglli.

Altro non mi ochore dirvi per ora. Sse vollette che ffacia chossa allquna, datemi avisso: ffarò vollentieri.

Dì 8 di llugllio 1517.

Lo vostro Andrea di Piero fFeruci nell'Opera, in fFirenze.

Allo mag[i]or mio onorando Michellang[n]ollo di lLodovicho Buonarotti.

In Charara.

DOCUMENT 1517e

1517 **July 12. Letter from Bernardo Nicholini to Michelangelo discussing the construction of the new foundations for the projected façade of the basilica of San Lorenzo, and of the model of the facade. (see Documents 1516a, 1517a, 1517b, 1517c and 1517d).** [*Archivio Buonarroti, Florence, X, n. 580, as transcribed in Paola Barocchi and Renzo Ristori, eds., Il carteggio di Michelangelo: Edizione postuma di Giovanni Poggi, 5 vols. (Florence: Sansoni Editore, 1965-1983): 1:293.*]

Michelagniolo reverendissimo, questa arete per mano di maestro Andrea, dal quale intenderete e' partichulari de' fondamenti, al quale vi piaccia dire quello s'à a seghuire; ché Nostro Signiore e Monsigniore Reverendissimo si rimettono al tutto a voi.

Domenico mi solecita vi richordi di quello modello, quale desiderebbono si faciessi quanto prima si potesi; e però ingiegniatevi o costì farlo o vedere di spedirsi quanto più presto posibile, a chausa li chontentiate di farlo loro vedere, perché sono fermisimi del medesimo animo. Non vi sia grave scrivere a Domenico quello vi ochorre e mandare la lettera per questo aportatore.

Non dirò per questa altro. Racomandomi a voi. Christo vi di[a a pigliare lo meglio].

Bernardo Nicholini in Firenze.

Domino *Michelagniolo Buonaroti in Charrara.*

DOCUMENT 1519a

1519 **November 4: Ricordo noting the demolition of two houses belonging to the Nelli family, and "some walls" of the church—probably the west wall of the Ginori corridor (*androne*), in preparation for construction of the New Sacristy.** [Ricordanza of Giovanbattista Figiovanni, c. 1530, as quoted in: Corti, 1964, p. 28; and Reiss, 1993, p. 339, n. 3.]

Et con quantità di manovali et muratori si posono a disfare dua case della famiglia de' Nelli et delle mura della chiesa da quella parte dove la sacrestia far si doveva.

DOCUMENT 1520a

1520 **March (new style?). New Sacristy is begun.** [*Istorie di Giovanni Cambi*, ed. Fr. Ildefonso di S. Luigi, in *Delizie degli Eruditi Toscani*, vol. XXII, Florence, 1786, p. 161, as quoted in Elam, 1979, p. 174, n. 24.]

l'anno 1519 del mese di Marzo all'uscita di detto anno Papa Lione fece cominciare alla Chiesa di S. Lorenzo una sacrestia di verso la via della Stufa, che vera un poco di porticiuola per comodita del popolo andare in Chiesa

DOCUMENT 1653a

1653-5 ***Sepoltuario* by Stephano Rosselli listing patronage, consecration, and tombs of all chapels in the basilica.** [As paraphrased and annotated in Ginori Conti, 1940, pp. 76-79.]

Discussion: Despite the late date, this inventory is particularly valuable in identifying original [??] patronage of the nave chapels.

Nella navata di destra [north side aisle]:

1ª Cappella di padronato dei Medici detta della Visitazione.

2ª Cappella dei Ginori allora di patronato di Carlo di Leonardo di Carlo Ginori, intitolata a S. Giuseppe. All'Altare è la tavola dello Sposalizio della Madonna, di Giovanni Battista di Iacopo detto il Rosso, fiorentino; e nella volta l'arme dei Ginori.

3ª Degli Inghirami (allora appartenente ai Ducci) intitolata a S. Lorenzo.

4º Dei Martelli, intitolata a S. Gismondo. Con iscrizione a Baccio Martelli, ammiraglio, prima a servizio di Enrico re di Francia e poi di Cosimo dei Medici.

5º Dei Ginori, intitolata a S. Girolamo; era appartenuta—dice Roselli [sic.]*—agli eredi del quondam Bernado Ginori, ed allora era di Giovanni di Andrea Ginori; con arme nella volta.*

6ª Cappella della famiglia Buonaiuti, intitolata a S. Cristofano "con tavola di chiaro scuro" rappresentante S. Anna, di mano di fra Bartolomeo.

Presso la porta di fianco che segue alla predetta cappella [i.e., the northern nave side door], *lapide di pietra con chiusino di marmo collo stemma Ginori, col giglio di Francia, accantonato, e l'iscrizione: "Agnolo del senatore Gino Ginori restaurò 1631."*

7ª Voltando a man destra ed entrando nel braccio destro della crocera: la cappella Corsi intitolata a S. Giuliano, già degli eredi di Francesco di Marco di Luca, dai quali passò nei Giani e quindi nei Corsi, con stemma della famiglia.

8ª Cappella dei Neroni intitolata a S. Lorenzo; dai Neroni il patronato passò in Raffaello di Francesco dei Medici. Presso questa cappella era il sepolcro di Giovanni delle Bande Nere (trasportato nella piazza 25 anni prima che il Rosselli scrivesse il sepoltuario).

9ª Proseguendo verso l'altar maggiore: Cappella intitolata a S. Bernardo, dei Ciai, famiglia estinta, dalla quale il patronato della cappella passò nella famiglia Ridolfi; allora apparteneva a Lorenzo e Luigi Ridolfi.

10ª Cappella della famiglia Della Stufa, intitolata a S. Bernardo.

11ª Cappella maggiore intitolata a S. Bernardo, di padronato della famiglia Medici regnante; a piè dei gradini dell'altare nel mezzo della chiesa, sepoltura di Cosimo dei Medici il vecchio, con ornamenti di porfido e chiusini di bronzo traforato "che sfondano nella chiesa sotterranea."

12ª Alla cappella maggiore segue la cappella dei Rondinelli intitolata a S. Concordia.

13ª "Segue appresso la cappella intitolata a S. Niccolò della famiglia dei Ginori, che è l'ultima di questa testata e viene a essere nel canto accanto alla porta, per la quale si entra nella sagrestia de' preti. Vi è l'arme di questa famiglia nella volta e nella finestra vetriata. Et appartiene il giuspatronato di quella agli eredi di Tommaso di Giovanni Battista Ginori, de' quali e de' loro discendenti vivono oggi [1653] *Lodovico Alessandro e Giovanni Battista di….* [Giovanni Battista]*."*

14ª Sagrestia vecchia. Allora oltre le tombe oggi esistenti di Giovanni di Averardo e di Pietro e Giovanni di Cosimo dei Medici e di Maria Salviati madre del granduca Cosimo I, vi si trovavano anche la tomba di questo, della moglie Eleonora di Toledo, del Granduca Francesco, del principe don Antonio e di altri Medici; le cui salme poi furono portate nella grande cappella nuova [i.e., The Cappella dei Principi].

15ª Nella testata del braccio sinistro della chiesa, cappella del Sagramento, allora di patronato dei Guicciardini.

16ª Segue alla predetta la cappella dei Martelli intitolata alla Concezione della Madonna.

17ª Entrando nella navata sinistra, oltrepassato lo spazio dove Angelo Bronzino ha dipinto a fresco il martirio di S. Lorenzo, dopo laporta che immete nel chiostro [i.e., the southern nave side door] si trova la cappella "degli Aldobrandini di Madonna" intitolata essa pure alla Concezione. La tavola rappresenta però il martirio di S. Sebastiano, dipinto da Iacopo da Empoli.

18ª La seguente è della famiglia Taddei intitolata a S. Antonio.

19ª Viene poi la cappella della famiglia Cambibi, intitolata pur essa a S. Antonio, ma detta del Crocifisso.

20ª Quindi altra cappella dei Neroni intitolata a S. Leonardo, il patronato della quale era passato poi nei Dell'Antella.

21ª Accanto a questa, cappella dei Medici, intitolata ai Diecimila martiri, appartenente agli eredi di messer Francesco di Niccolò de' Medici.

22ª Ultima da questa parte, la cappella dei Marignolli, intitolata a S. Matteo.

Figure 1-1. Basilica of San Lorenzo, Florence, viewed straight down the middle of the nave. From Peter Murray, *The Architecture of the Italian Renaissance*, 1963, Fig. 19.

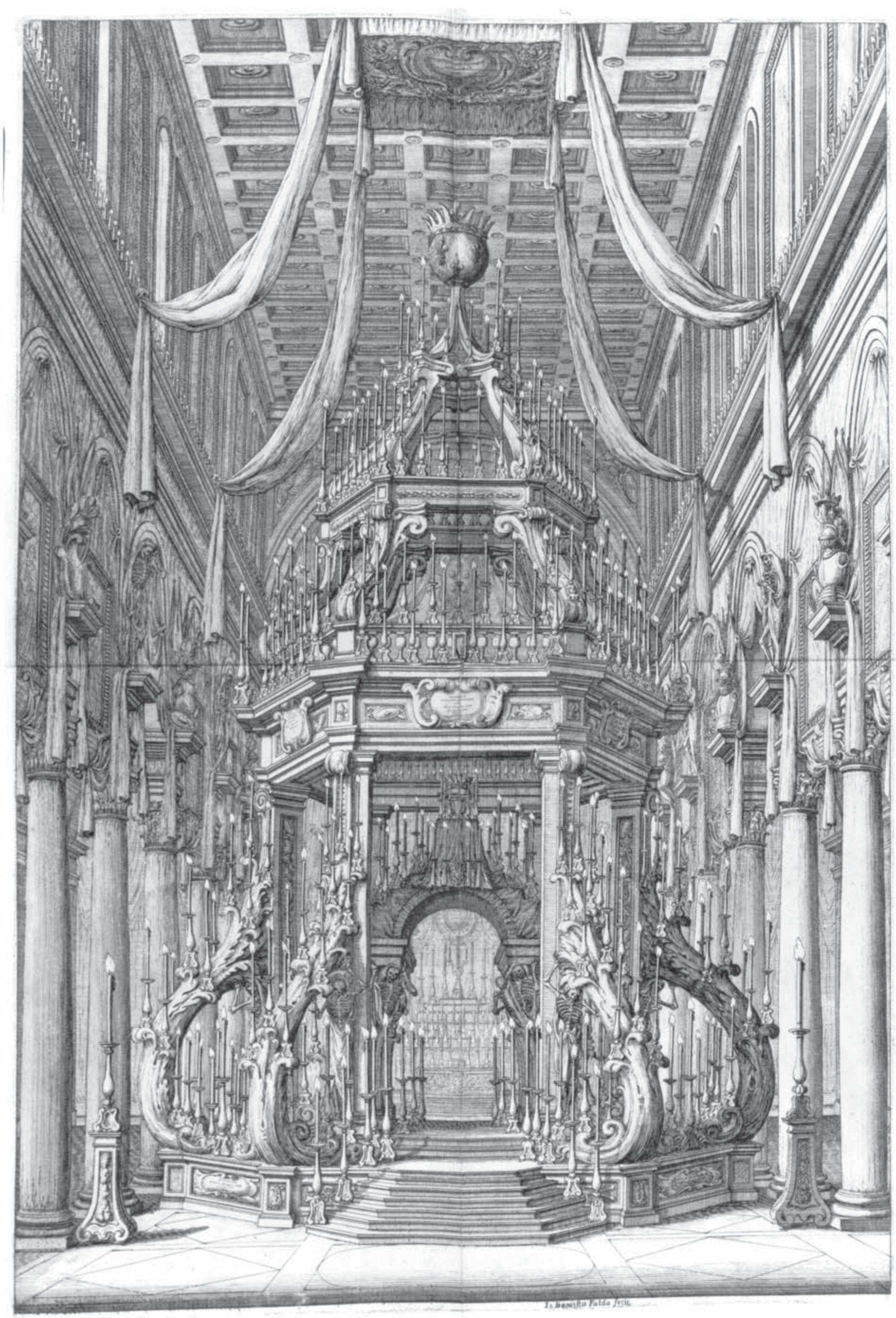


Figure 1-2. Funeral Apparatus for Ferdinando II de' Medici, Grand Duke of Tuscany inside the Basilica of San Lorenzo in Florence, with nave pavement shown. From: Manfredi Mancigni, *Esequie del serenissimo Ferdinando II. gran duca di Toscana celebrate in Firenze dal serenissimo gran duca Cosimo III*, 1671. Illustration by Giovanni Baptista Falda.

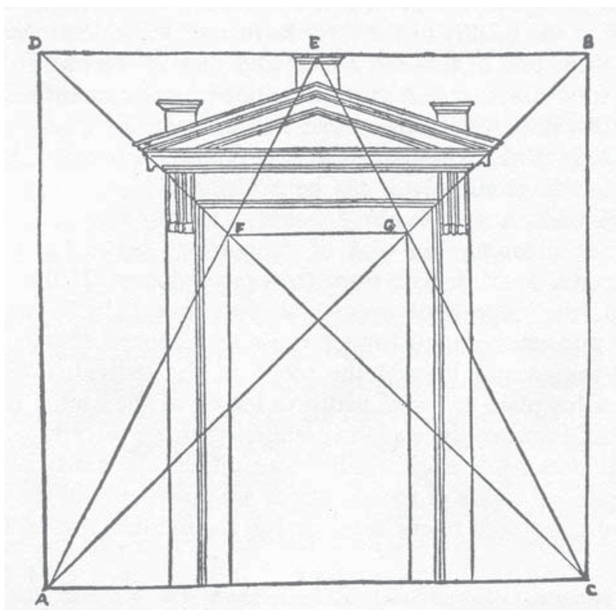


Figure 1-3. Construction of a doorway, from Sebastiano Serlio, *Il primo libro d'architettura*, 1545, as reproduced in Rudolf Wittkower, *Architectural Principles in the Age of Humanism*, 1952, Fig. 10.

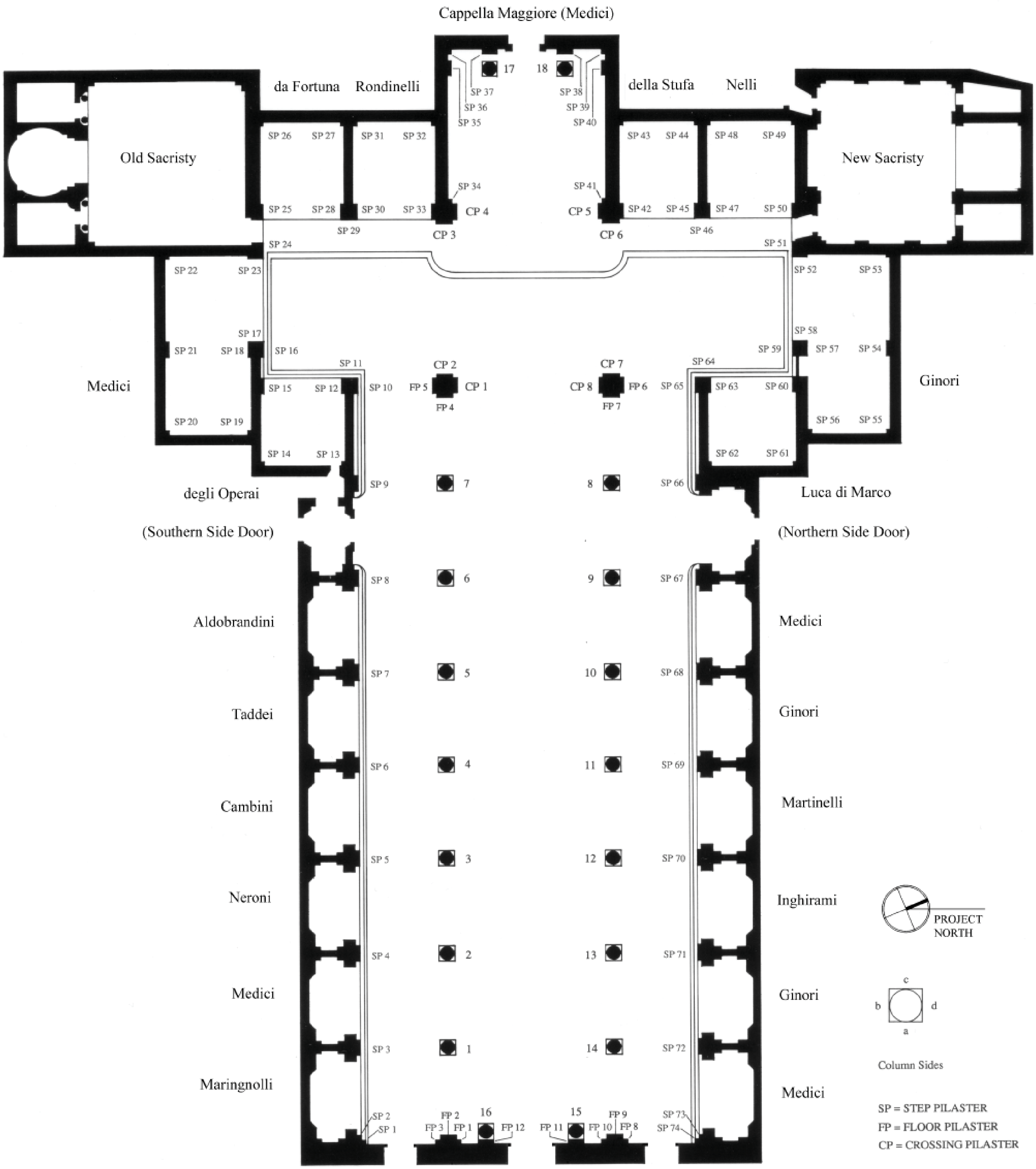


Figure 2-1. Basilica of San Lorenzo, floor plan with column and pilaster numbers, and original chapel patrons.

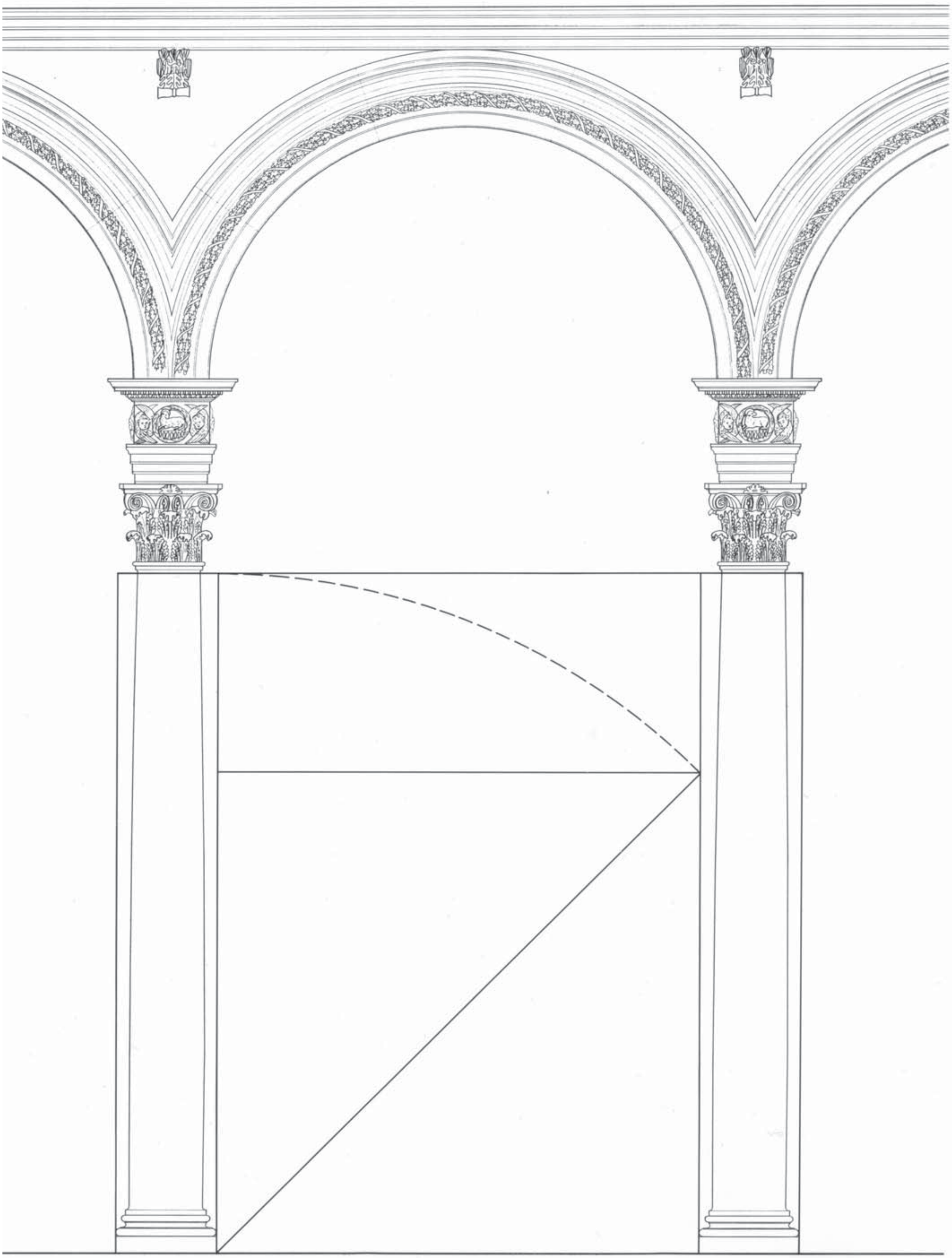
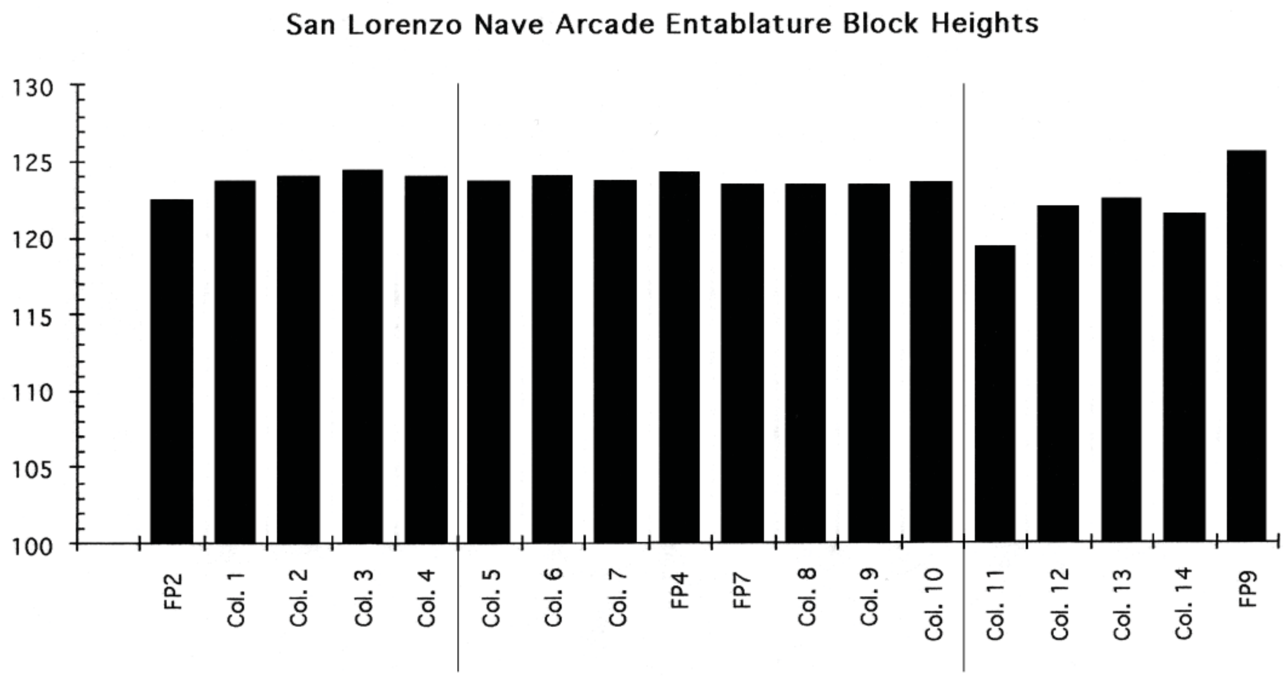


Figure 2-2. Basilica of San Lorenzo, nave arcade bay. The overlay showing overlapping square and root-2 rectangle proportions, measured plinth-to-plinth, is drawn precisely to scale.

Figure 2-3. Basilica of San Lorenzo, north nave arcade, looking east.

Figure 2-4. North nave arcade view. The heights of the last three columns on the right are visibly irregular.



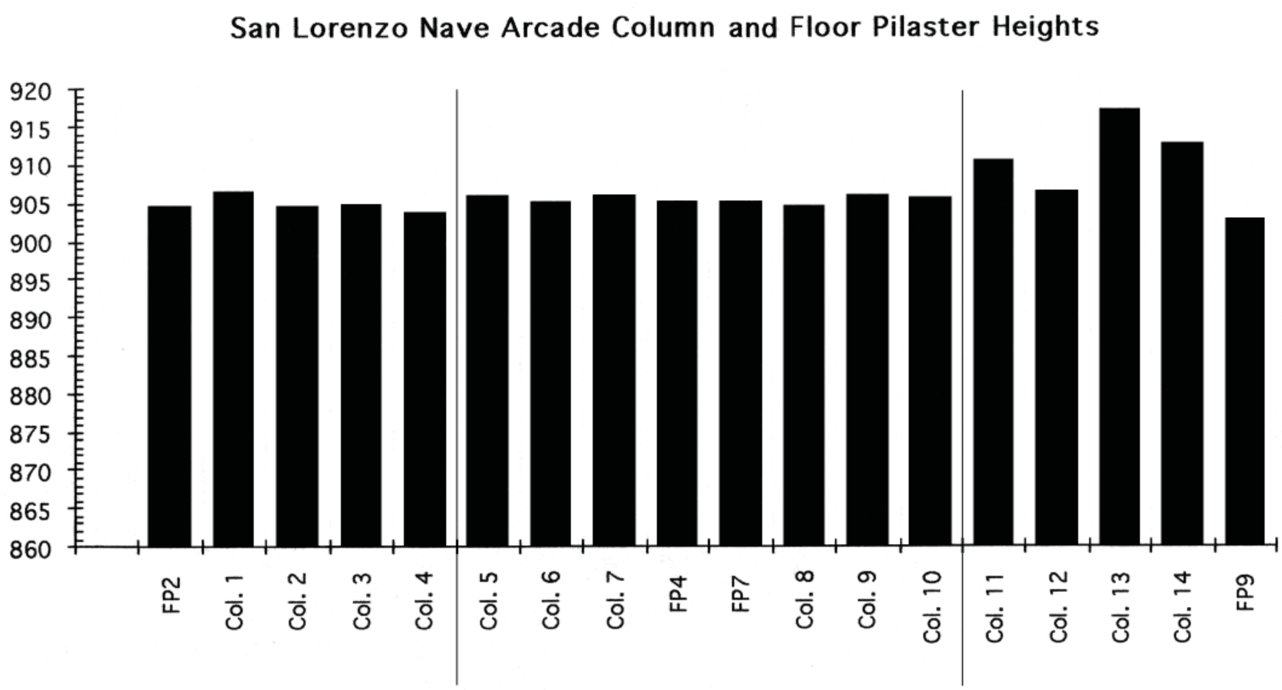


Figure 2-5. Bar charts representing selected nave arcade measurements. Refer to Figure 3-1 for numbering and Appendix 9.1 for measurements.

Figure 2-6. San Lorenzo Nave Arcades Phase II, Column 4, side b/c.

Figure 2-7. San Lorenzo Nave Arcades Phase II, Column 4, side b/c, detail.

Figure 2-8. San Lorenzo Nave Arcades Phase I, Column 8, side b.

Figure 2-9. San Lorenzo Nave Arcades Phase II, Column 4, side d.

Figure 2-10. San Lorenzo Nave Arcades Phase I, Column 5, side b.

Figure 2-11. San Lorenzo Nave Arcades Phase II, Column 14, side b.

Figure 2-12. San Lorenzo Nave Arcades Phase I, Column 6, side b.

Figure 2-13. San Lorenzo Nave Arcades Phase II, Column 11, side b.

Figure 2-14. San Lorenzo Nave Arcades Phase I, Column 10, side b, capital detail.

Figure 2-15. San Lorenzo Nave Arcades Phase II, Column 11, side b, capital detail.

Figure 2-16. San Lorenzo Nave Arcades Phase I, Column 9, side b, capital abacus detail.

Figure 2-17. San Lorenzo Nave Arcades Phase II, Column 13, side b, capital abacus detail.

Figure 2-18. Basilica of San Lorenzo, Column 9, Side b, volute detail.

Figure 2-19. Basilica of San Lorenzo, Column 13, Side b, volute detail.

Figure 2-20. San Lorenzo Nave Arcades Phase I, Column 9, side b, architrave block detail.

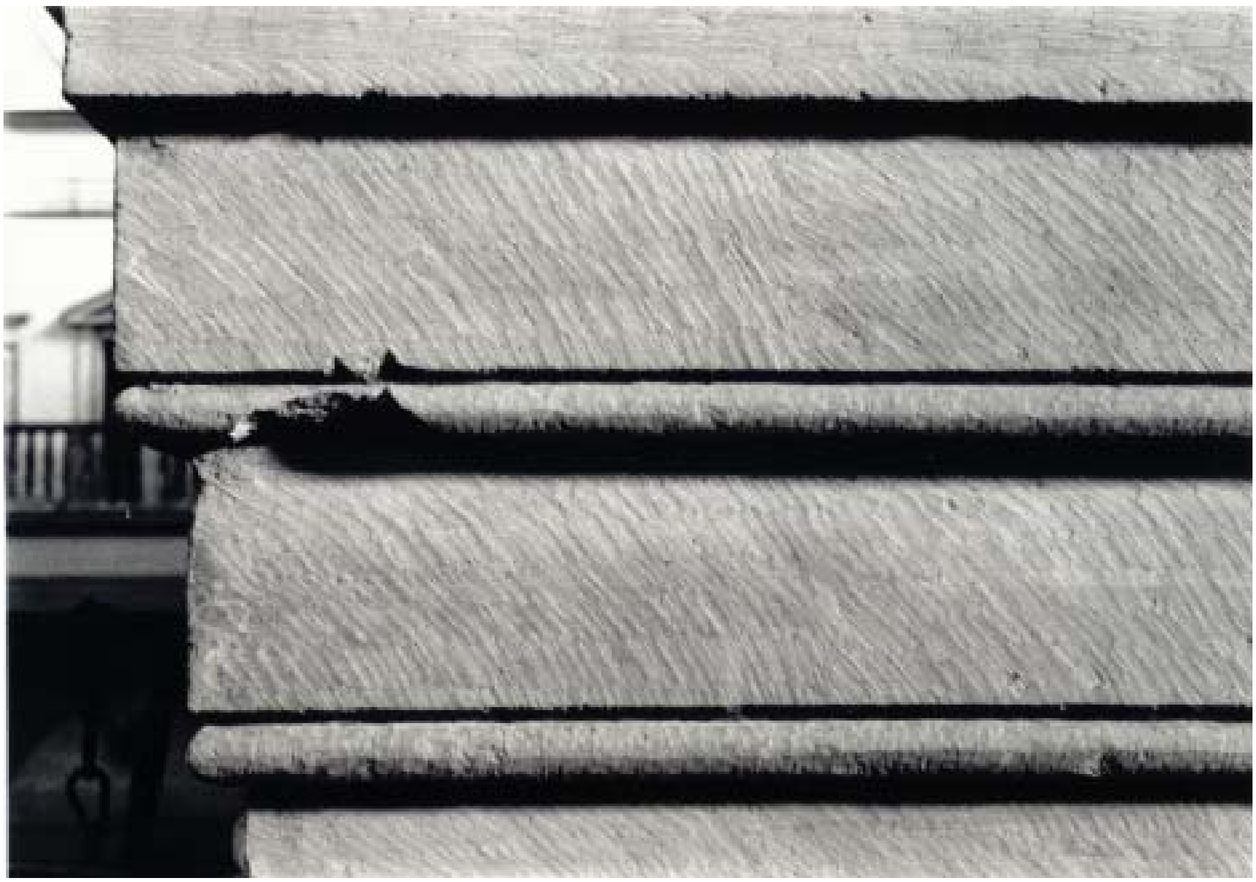


Figure 2-21. San Lorenzo Nave Arcades Phase II, Column 4, side c, architrave block detail.

Figure 2-22. San Lorenzo Nave Arcades Phase I, Column 7, side a, frieze block.

Figure 2-23. Basilica of San Lorenzo, Column 9, Side b, frieze block detail.

Figure 2-24. San Lorenzo Nave Arcades Phase I, Column 9, side b, frieze block and crown moulding.

Figure 2-25. San Lorenzo Nave Arcades Phase II, Column 3, side a, frieze block.

Figure 2-26. San Lorenzo Nave Arcades Phase II, Column 12, side a, frieze block detail.

Figure 2-27. Basilica of San Lorenzo, Column 11, Side d, frieze block detail.

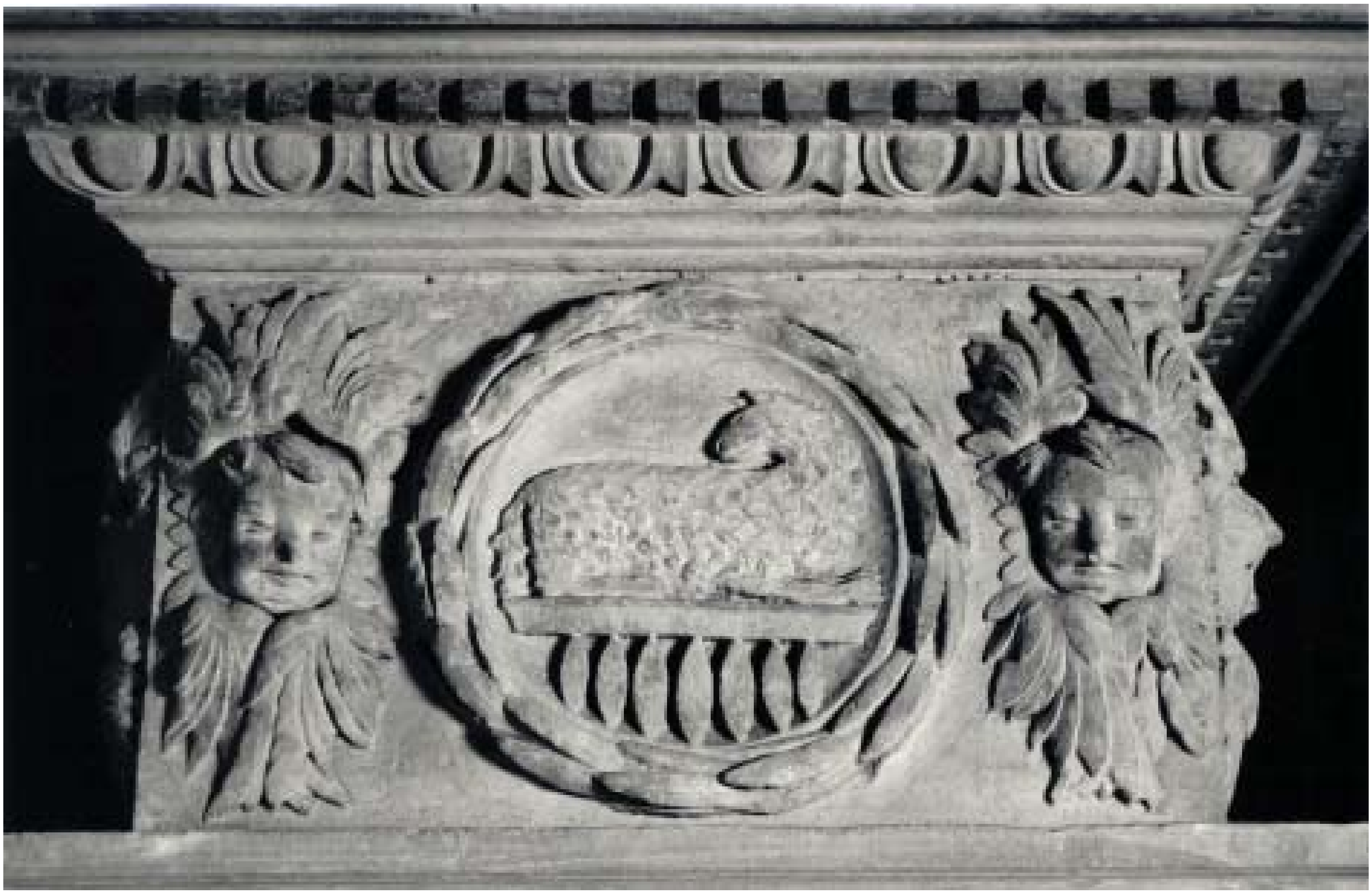


Figure 2-28. San Lorenzo Nave Arcades Phase II, Column 13, side d, frieze block and crown moulding.

Figure 2-29. San Lorenzo Nave Arcades Phase II, Column 11, side b, frieze block and crown moulding.

Figure 2-30. San Lorenzo Nave Arcades Phase II, Floor Pilasters 1 and 2, sides c and d, detail.

Figure 2-31. San Lorenzo Nave Arcades Phase I, Floor Pilasters 4 and 5, sides c and d, detail.

Figure 2-32. San Lorenzo Nave Arcades Phases I/II, archivolt detail above Column 10, side b.

Figure 2-33. San Lorenzo Nave Arcades Phases I/II, archivolt detail above Column 5, side d.

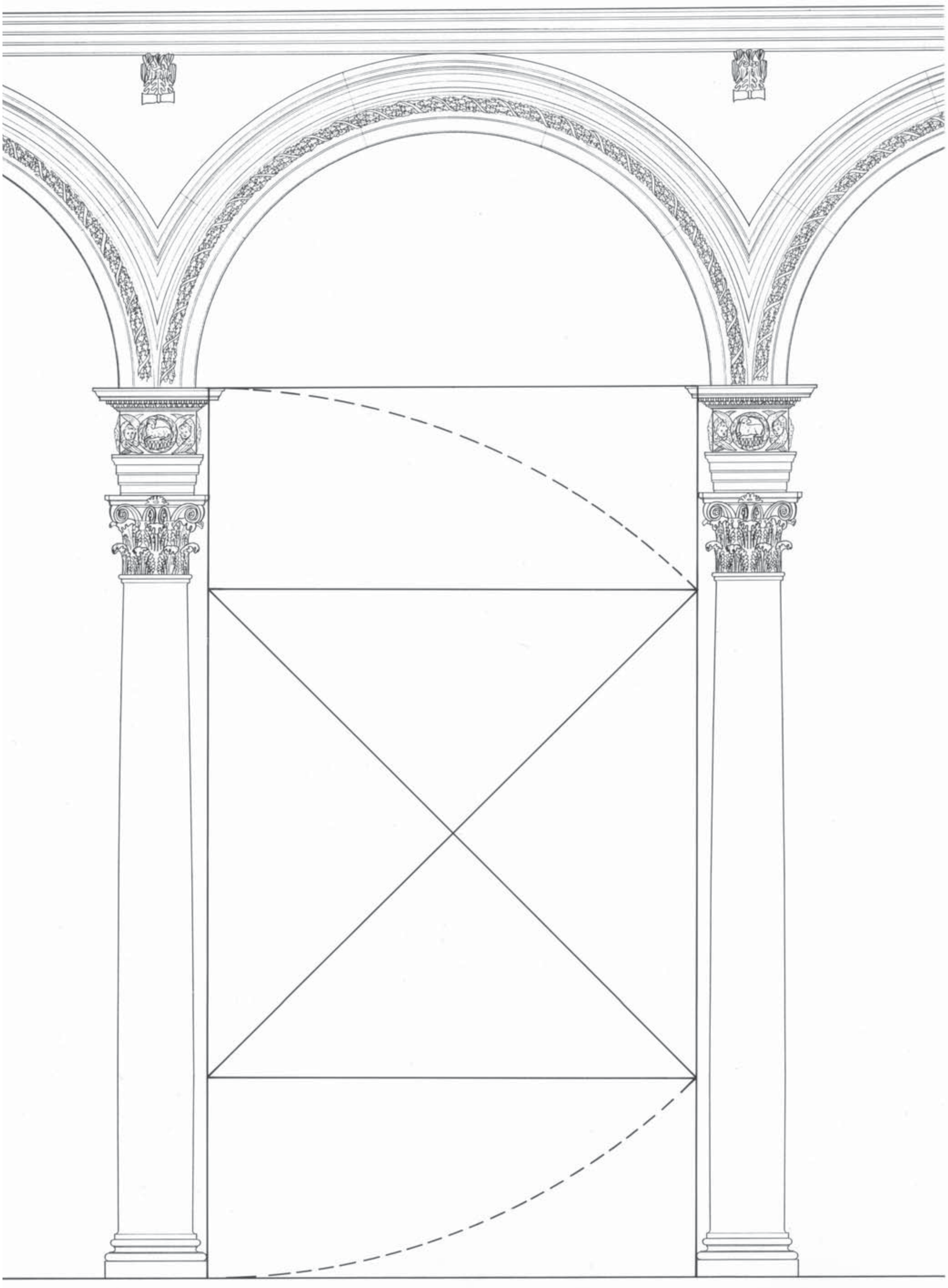


Figure 2-34. Basilica of San Lorenzo, nave arcade bay with overlay showing dual diagon proportion, measured plinth-to-plinth.

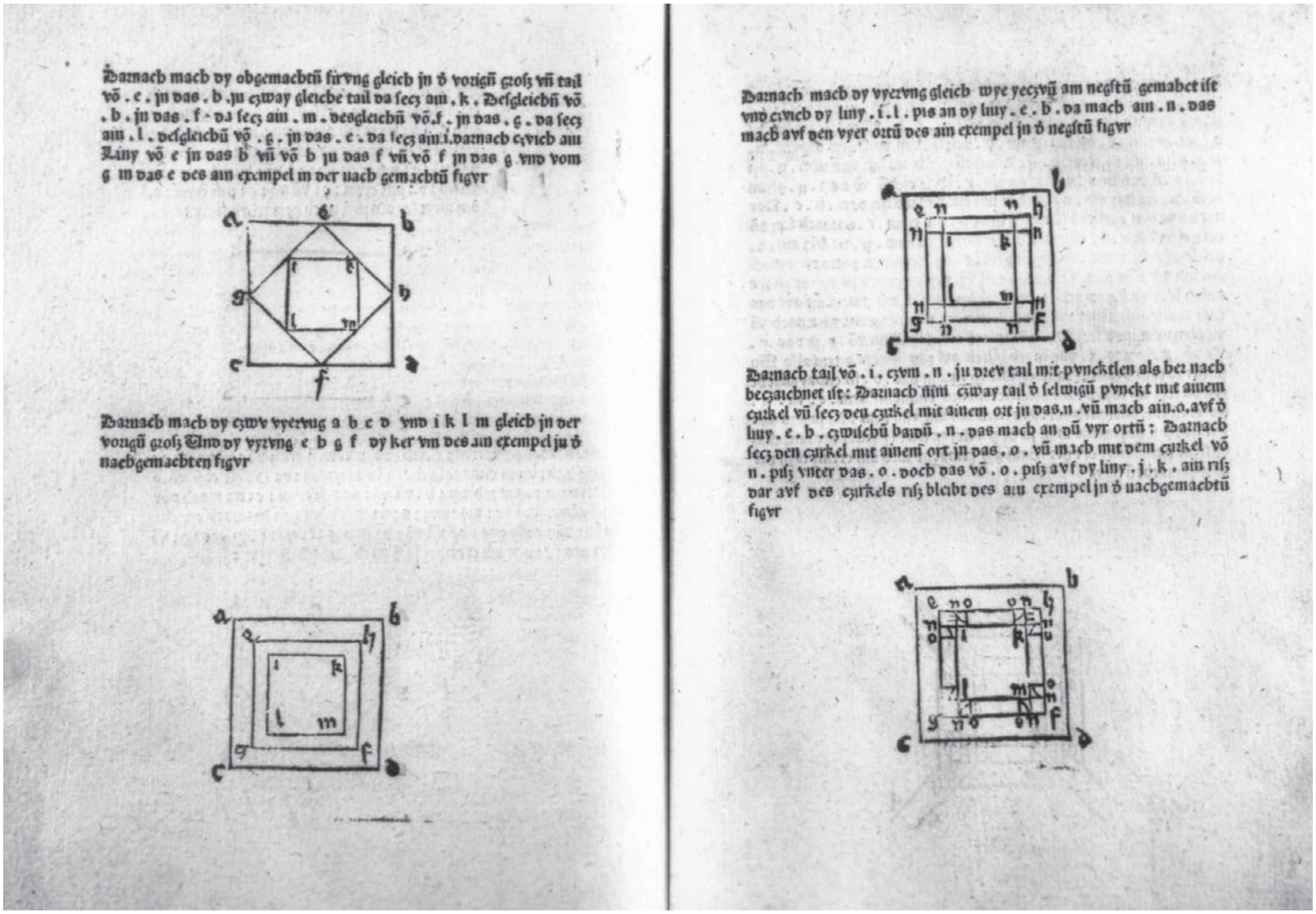


Figure 2-35. Mathes Roriczer, the rotation of squares technique, “Büchlein von der Fialen Gerechtigkeit” (1486).

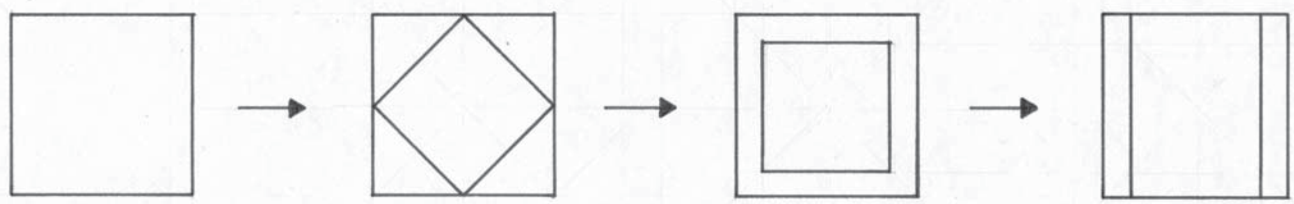


Figure 2-36. Derivation of the overlapping square and root-2 rectangle proportions from rotated squares.

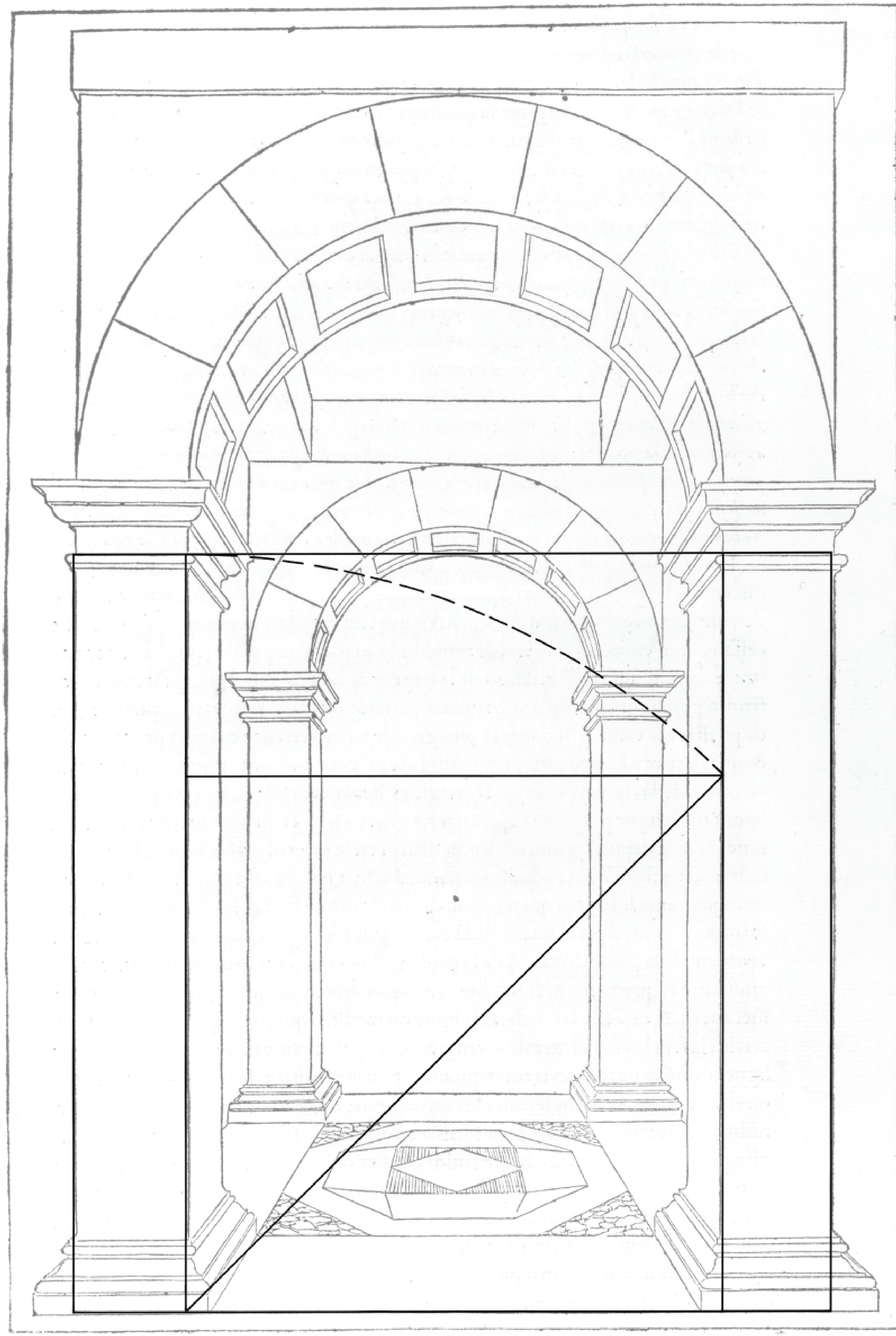


Figure 2-37. Sebastiano Serlio, perspective portal, *Secondo Libro* (1545), with proportional overlay added by the author.

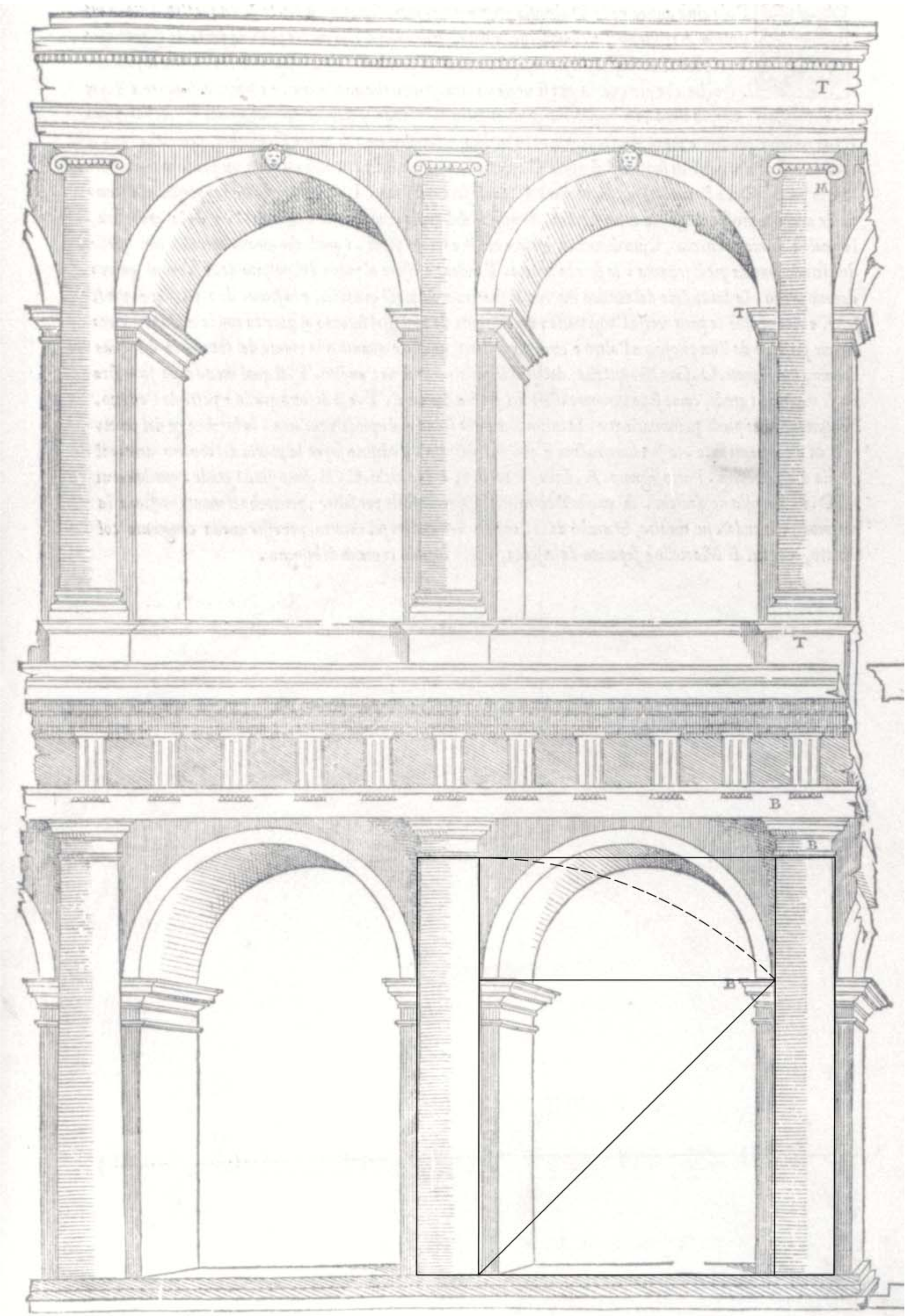


Figure 2-38. Sebastiano Serlio, Theater of Marcellus, Rome, *Terzo Libro* (1540), with proportional overlay added by the author.

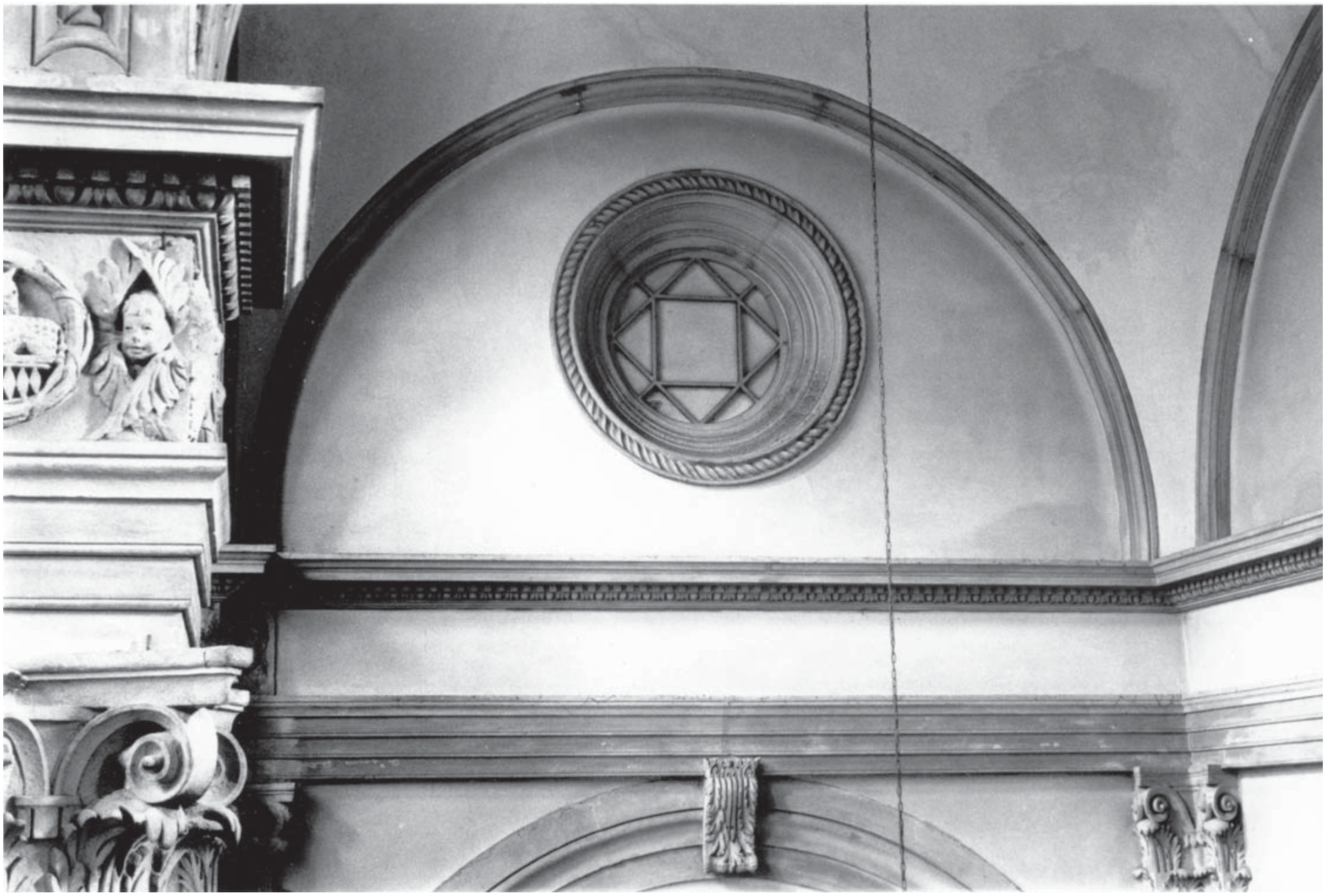


Figure 2-39. Basilica of San Lorenzo, north side aisle window.

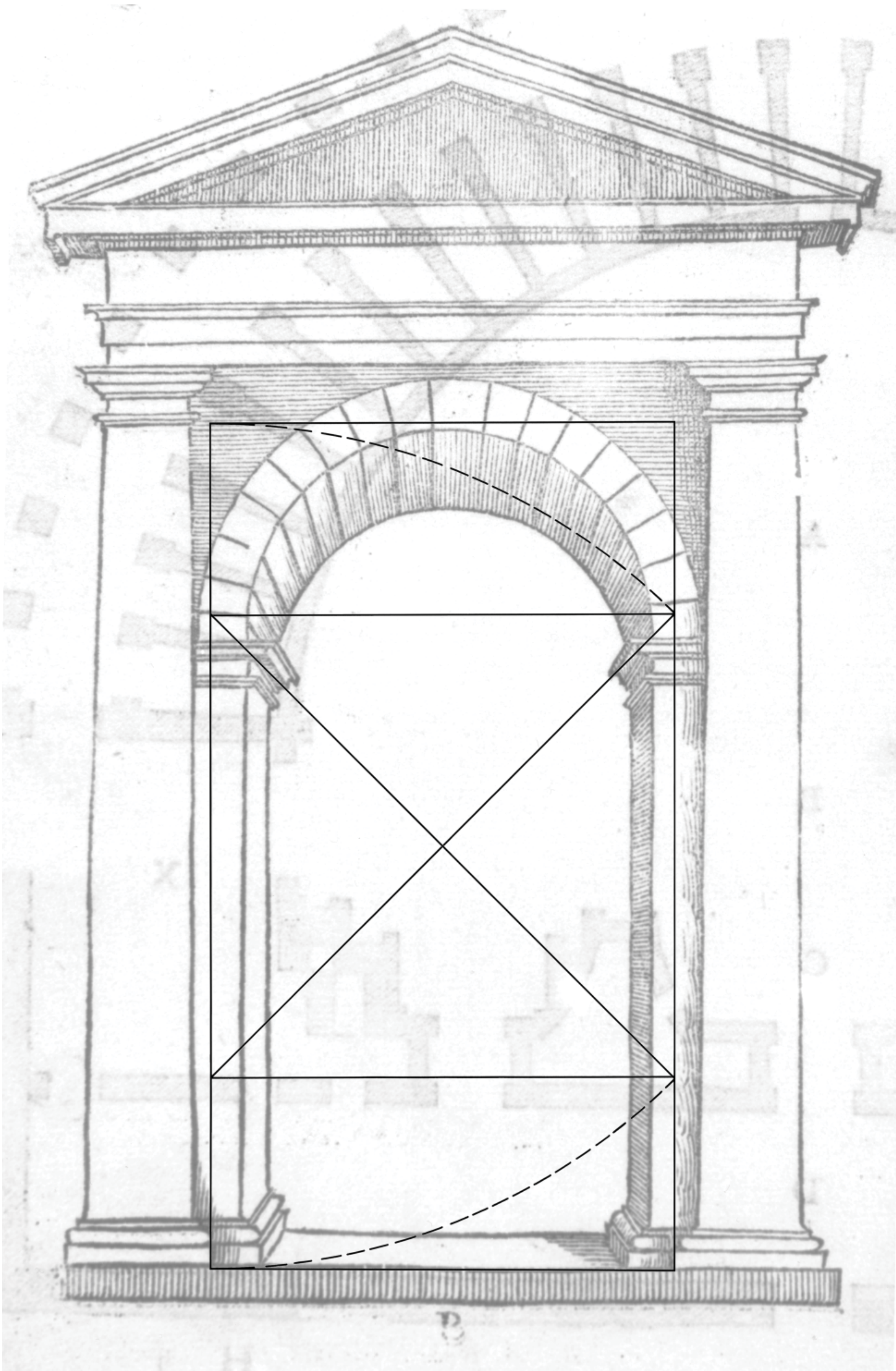


Figure 2-40. Sebastiano Serlio, Roman Portal, Spoleto, *Terzo libro* (1540), with proportional overlay added by the author.

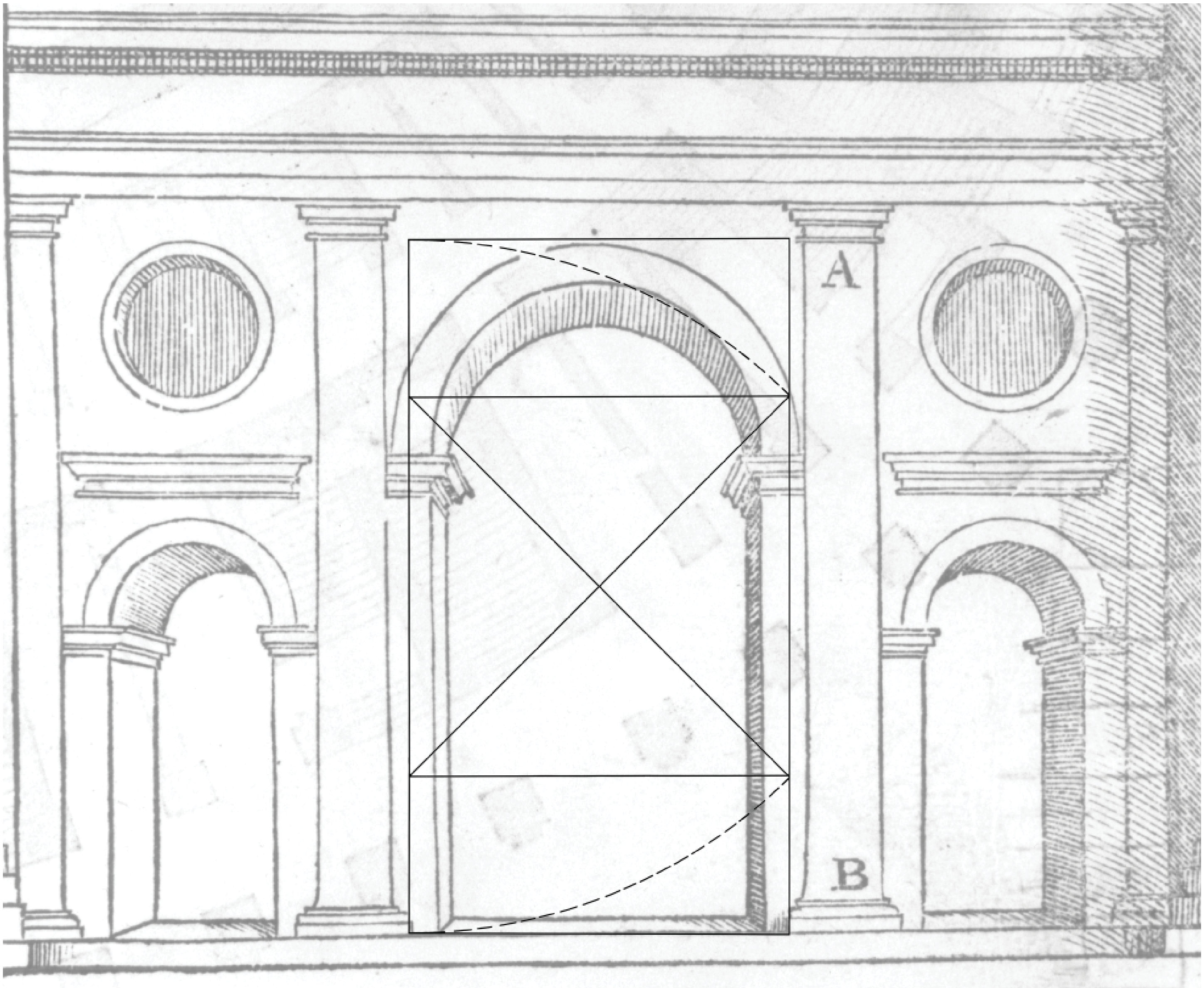
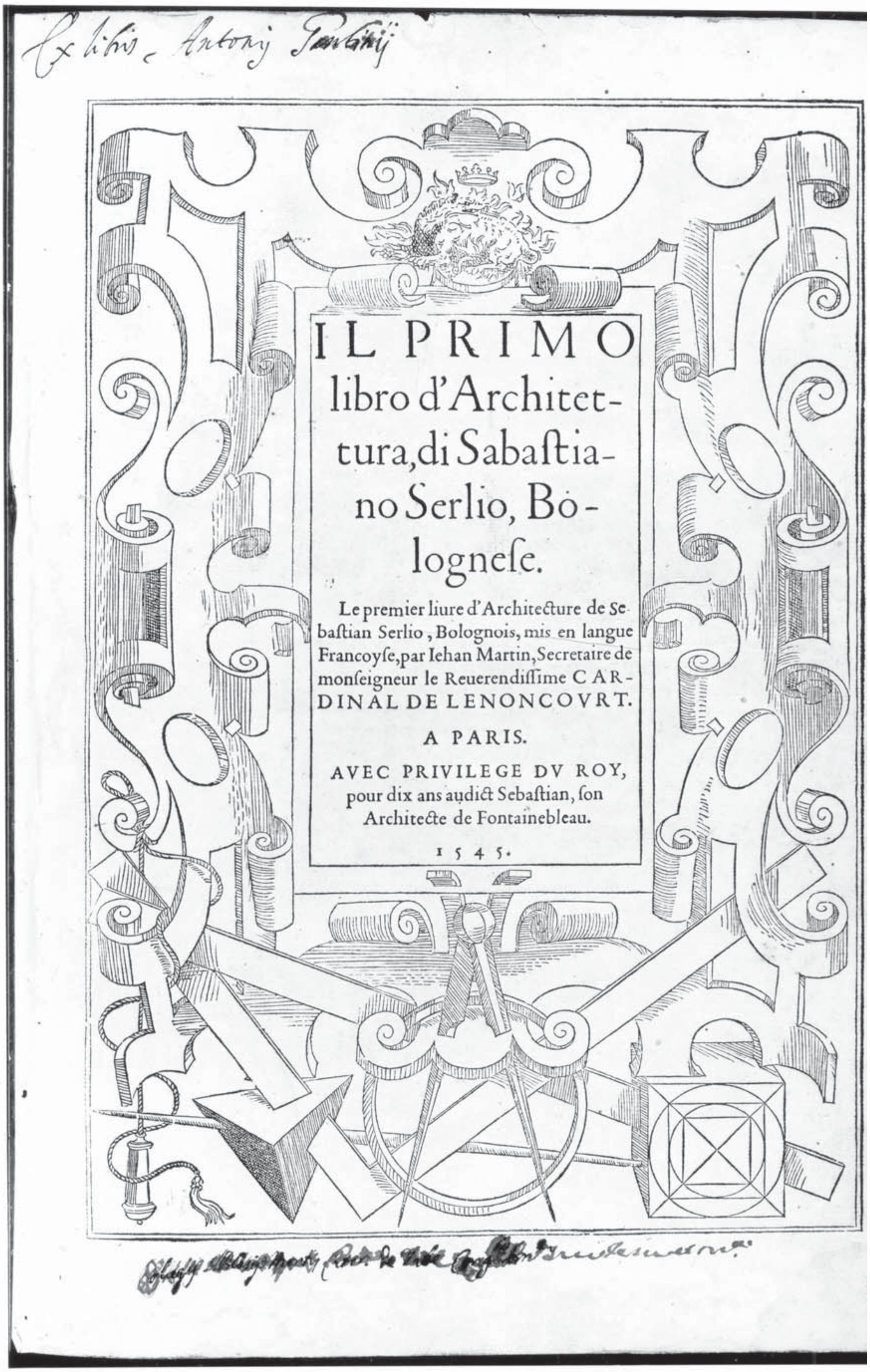


Figure 2-41. Sebastiano Serlio, City Gate, Spello, *Terzo libro* (1540), with proportional overlay added by the author.



IL PRIMO
libro d'Architet-
tura, di Sabaſtia-
no Serlio, Bo-
logneſe.

Le premier liure d'Architecture de Se-
baſtian Serlio, Bolognois, mis en langue
Francoyſe, par Iehan Martin, Secretaire de
monſeigneur le Reuerendiſſime CAR-
DINAL DE LENONCOVRT.

A PARIS.

AVEC PRIVILEGE DV ROY,
pour dix ans audict Sebaſtian, ſon
Architecte de Fontainebleau.

1545.

Figure 2-42. Sebastiano Serlio, Title Page of *Il primo libro d'architettura* (1545). Note rotation of squares figure at lower right, with squares shown already rotated, as a series of inscribed squares and circles.

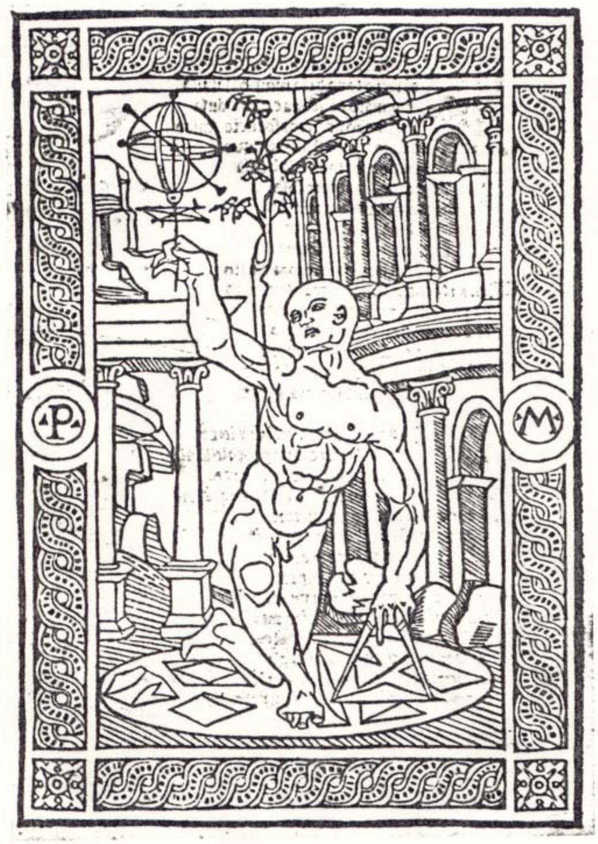


Figure 2-43. Woodcut from the from title page of the *Antiquarie prospetiche Romane*, c. 1500 (Rome biblioteca casanatense, reproduced in Pedretti) .

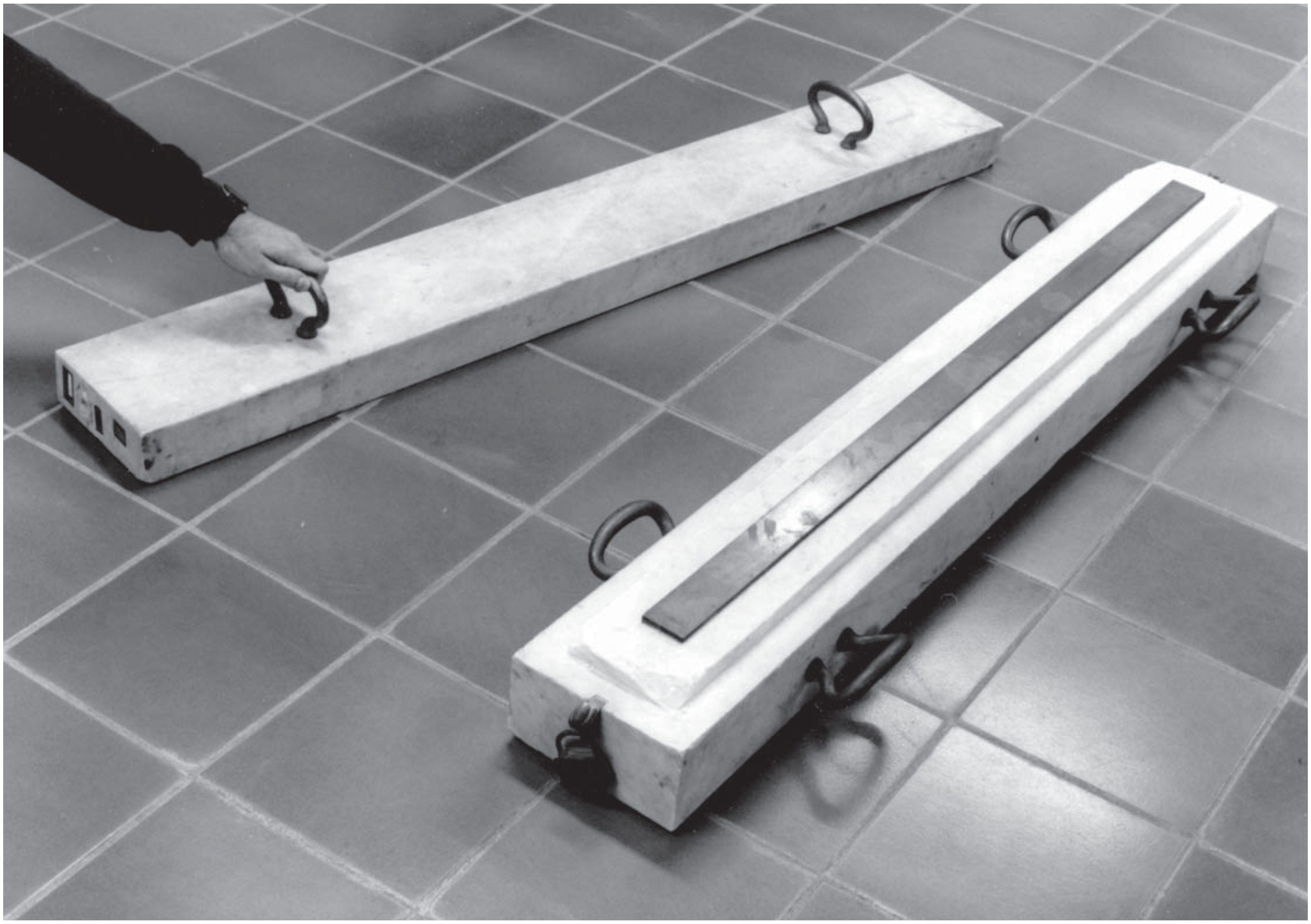


Figure 2-44. Campione ("sample") of Florentine *passetto*, or two *braccia* (1782).

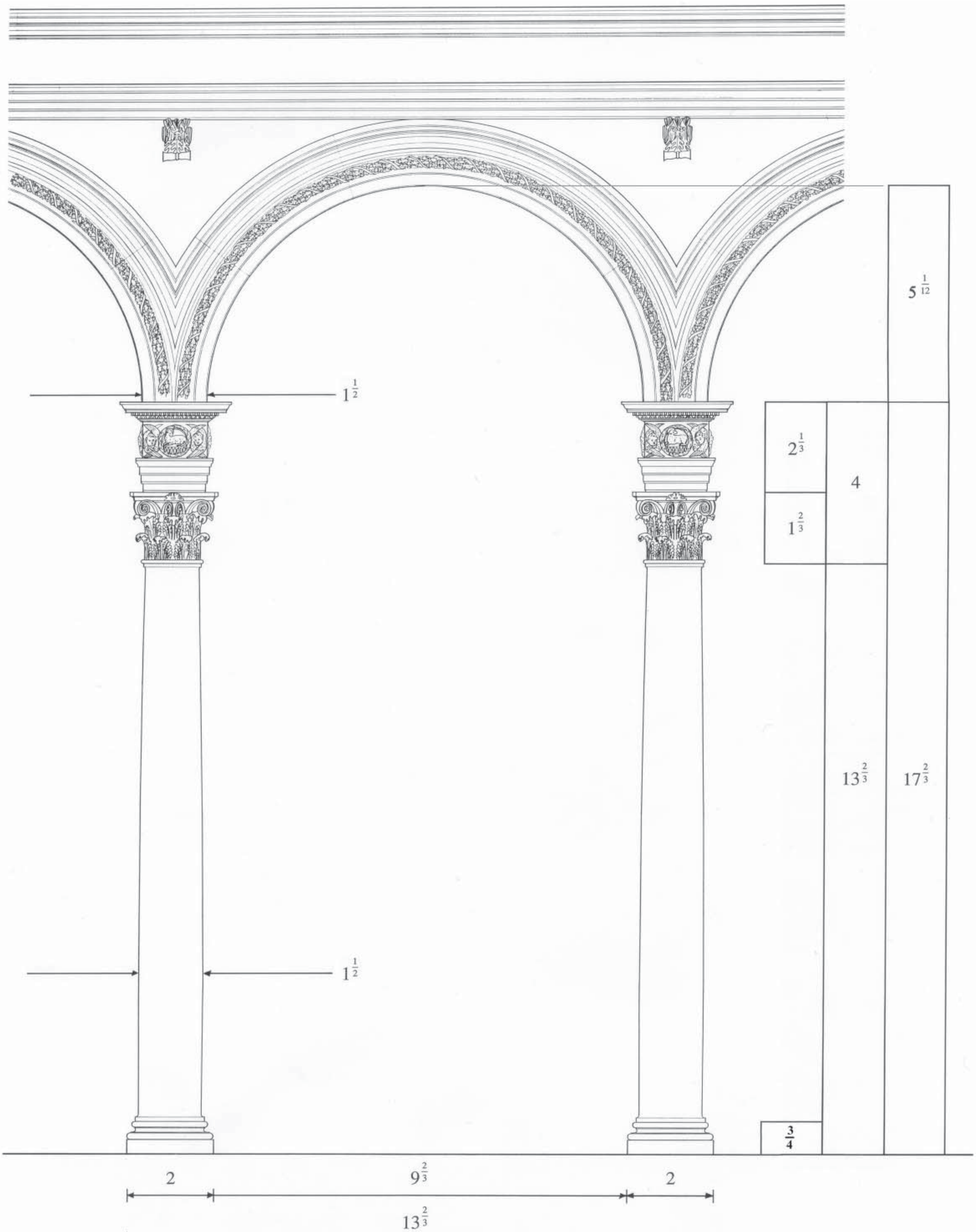


Figure 2-45. Basilica of San Lorenzo, nave arcade bay with braccio measurements assumed to be the original specifications for all bays.

Figure 2-46. Boethius the algorist competing with Pythagoras the abacist, from Gregor Reisch, *Margarita philosophia*, title page to Book IV, "Arithmetica Speculativa" (1503).

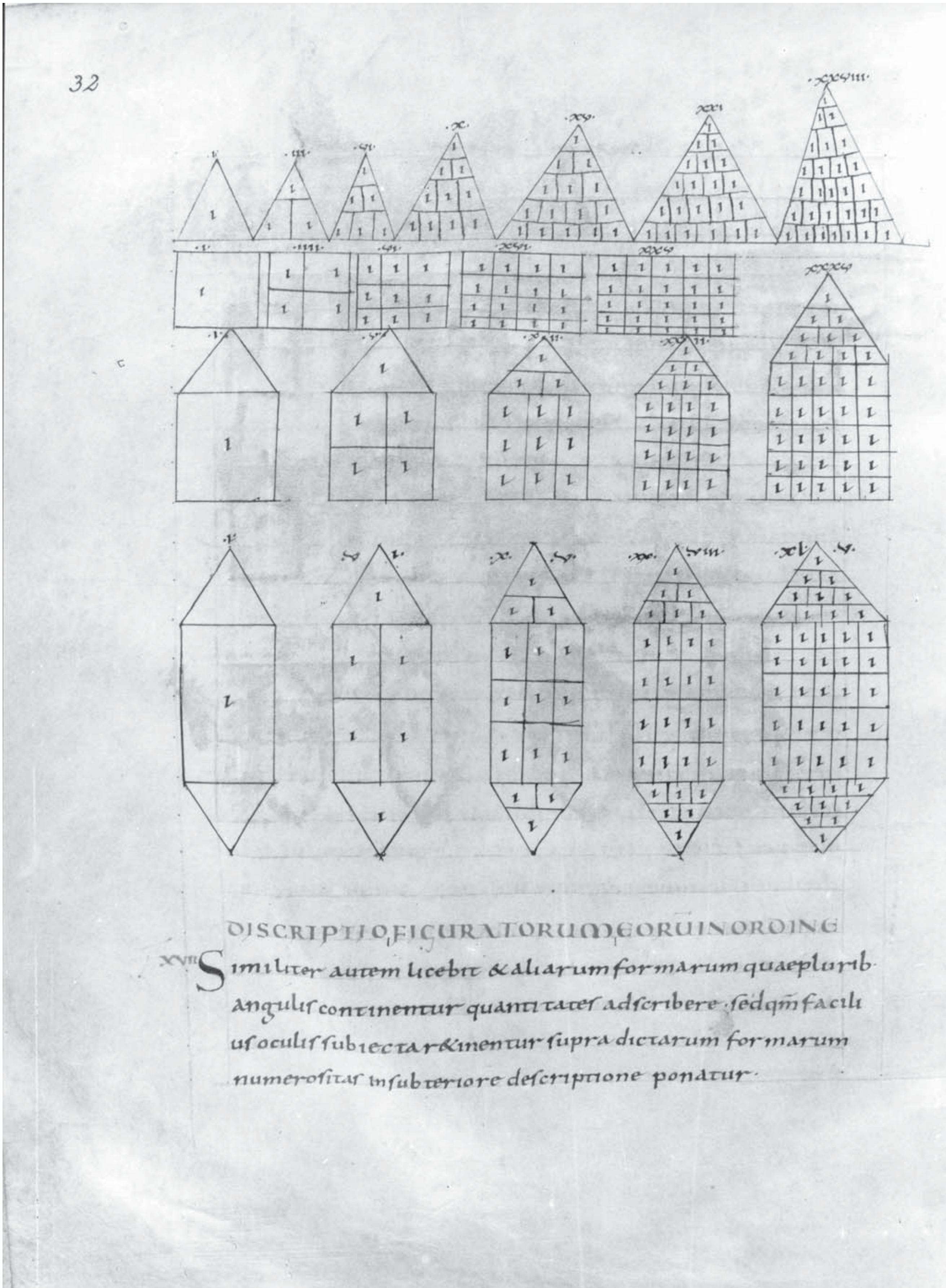


Figure 2-47. Polygonal numbers described in Severinus Boethius, *De institutione arithmetica* (c. 503 A. D.), as illustrated in the Liber mathematicalis bernwardi (c. 1000).

BOETHIAN NUMBER PROGRESSIONS

TRIANGULAR

Triangular Pyramidal Numbers	1	4	10	20	35	56	84...
Triangular Numbers	1	3	6	10	15	21	28...
Root Numbers	1	2	3	4	5	6	7...
Gnomons	1	1	1	1	1	1...	

SQUARE

Square Pyramidal Numbers	1	5	14	30	55	91	140...
Square Numbers	1	4	9	16	25	36	49...
Root Numbers	1	3	5	7	9	11	13...
Gnomons	2	2	2	2	2	2...	

PENTAGONAL

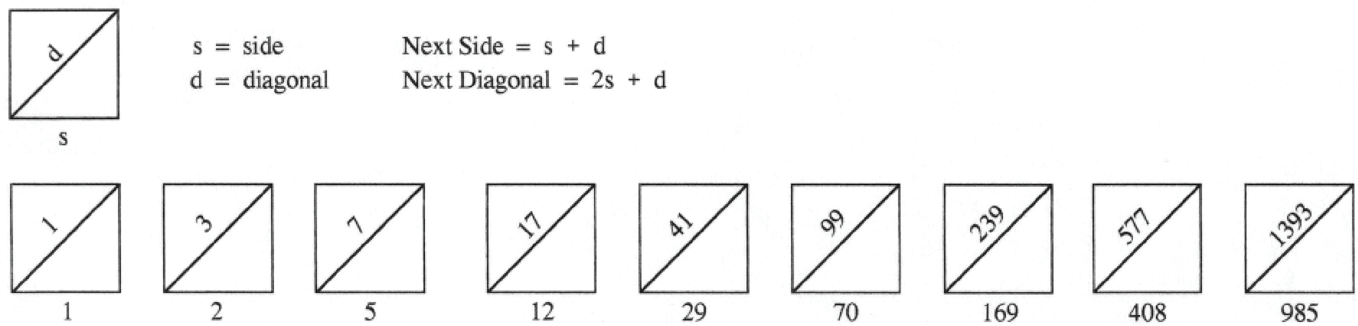
Pentagonal Pyramidal Numbers	1	6	18	40	75	126	196...
Pentagonal Numbers	1	5	12	22	35	51	70...
Root Numbers	1	4	7	10	13	16	19...
Gnomons	3	3	3	3	3	3...	

HEXAGONAL

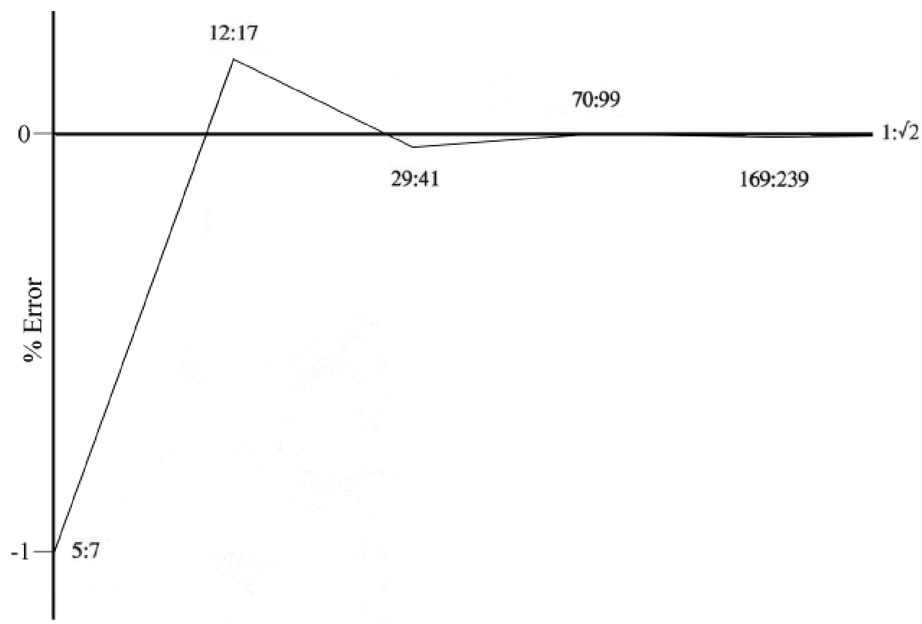
Hexagonal Pyramidal Numbers	1	7	22	50	95	161	252...
Hexagonal Numbers	1	6	15	28	45	66	91...
Root Numbers	1	5	9	13	17	21	25...
Gnomons	4	4	4	4	4	4...	

Figure 2-48. Some polygonal number and related progressions, interpolated from Boethius's *De institutione arithmetica* (see Figure 3-21).

THEON OF SMYRNA'S FORMULA



RELATIVE ACCURACY OF SIDE/DIAGONAL (1:√2) APPROXIMATIONS PRODUCED BY THEON'S FORMULA



RATIO			%ERROR
1:√2	=	1:1.414213562	0%
1:1	=	1:1	-29.29%
2:3	=	1:1.5	+6.07%
5:7	=	1:1.4	-1.005%
12:17	=	1:1.416666667	+0.17%
29:41	=	1:1.413793103	-0.03%
70:99	=	1:1.414285714	+0.05%
169:239	=	1:1.414201183	-0.0009%
408:577	=	1:1.414215686	+0.00015%

Figure 2-49. Theon of Smyrna's formula for generating infinite progressions of whole number approximations of the side/diagonal ratio (1:√2), with successive generations of the formula (top) and charts showing increasing accuracy of each generation (bottom).

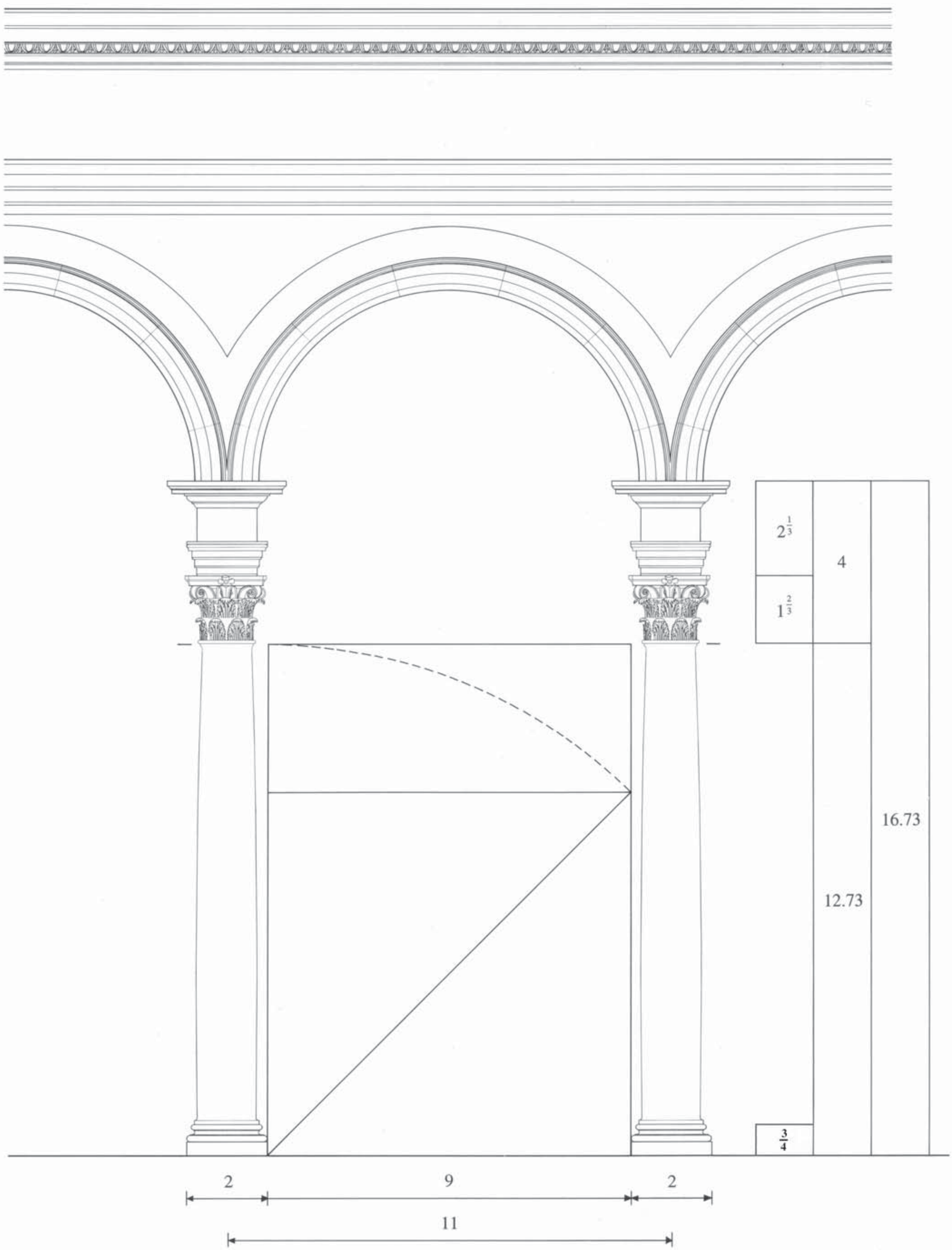


Figure 2-50. Basilica of Santo Spirito, arcade bay with overlays showing root-2 rectangle proportion and measurements in braccia. Partial braccia are indicated in modern decimal notation when no common fraction is clearly implied.

Figure 2-51. Basilica of San Lorenzo, view looking south showing nave (left) and Medici Chapel (right).

Figure 2-52. Step Pilaster Capital 16, displaying very high quality of detail and workmanship, probably realized under Brunelleschi's direct supervision (c. 1421-1428).

Figure 2-53. Step Pilaster Capital 11, displaying typical transept pilaster capital quality, probably realized under the supervision of Michelozzo (c. 1442-1450).

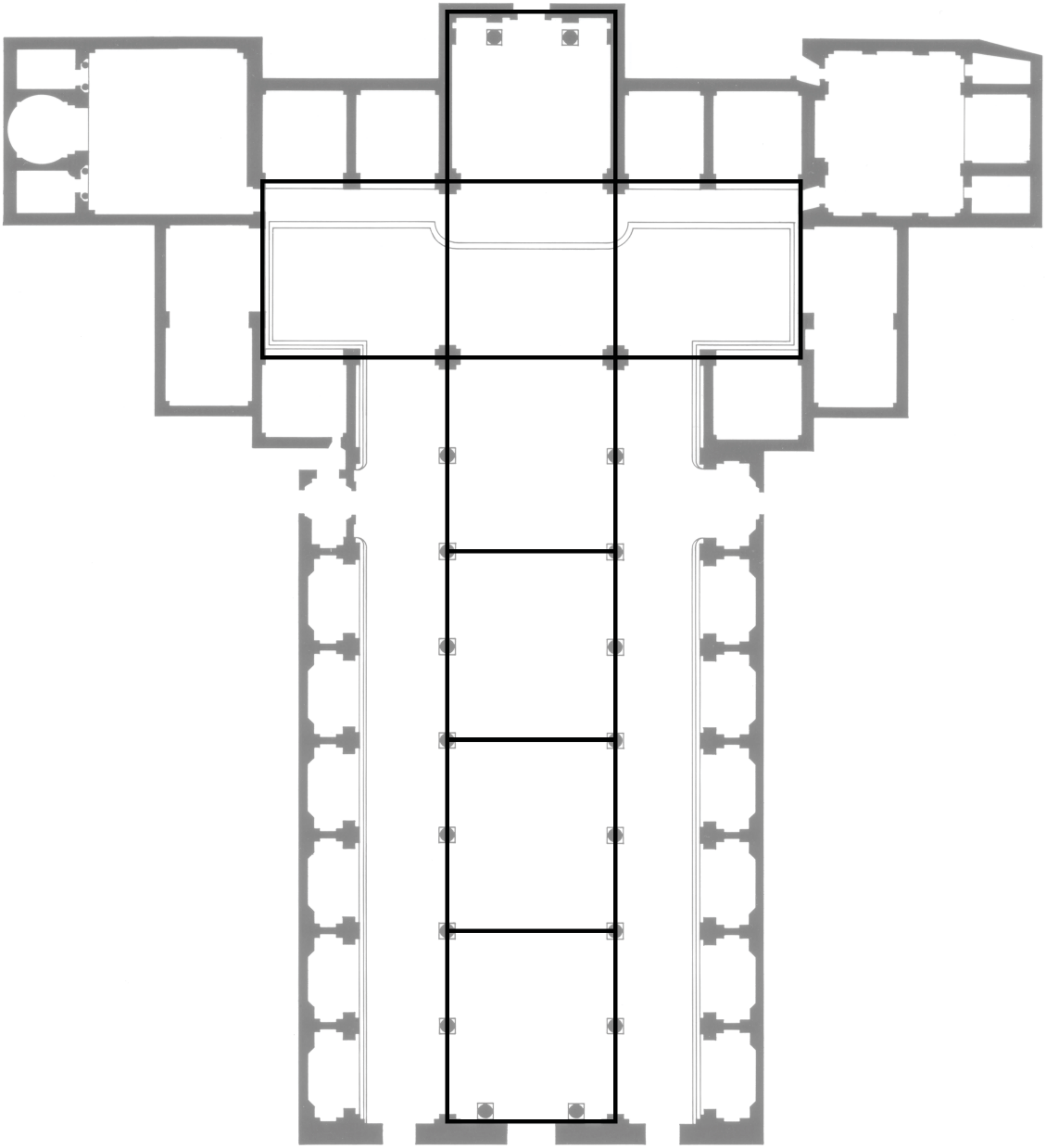


Figure 3-1. Basilica of San Lorenzo, floor plan with overlay showing conceptual modularity implied by eight approximate squares that form a cruciform central spine.

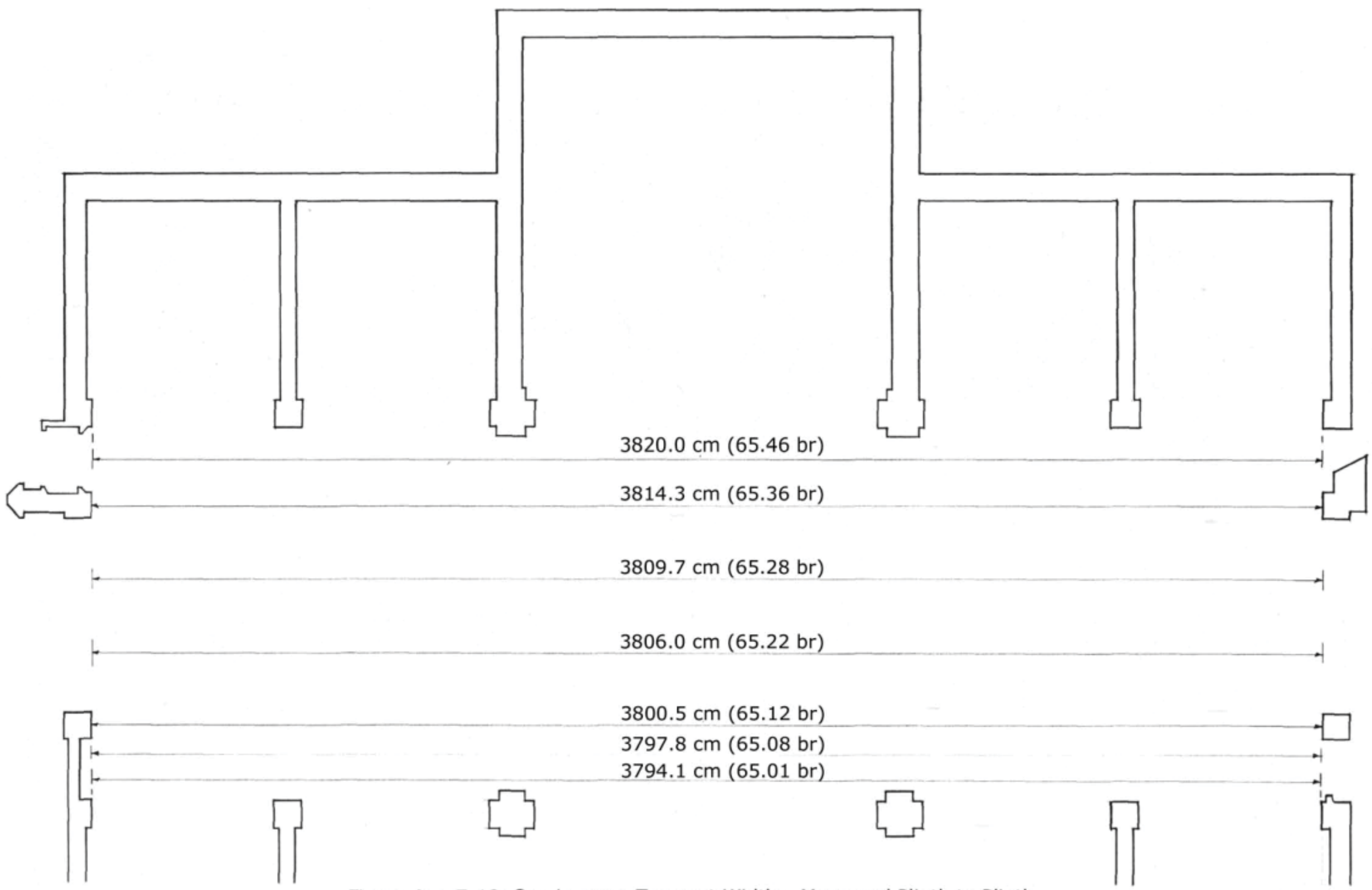


Figure App.7-10: San Lorenzo Transept Widths, Measured Plinth to Plinth

Figure 3-2. Basilica of San Lorenzo. Transept widths, measured plinth to plinth.

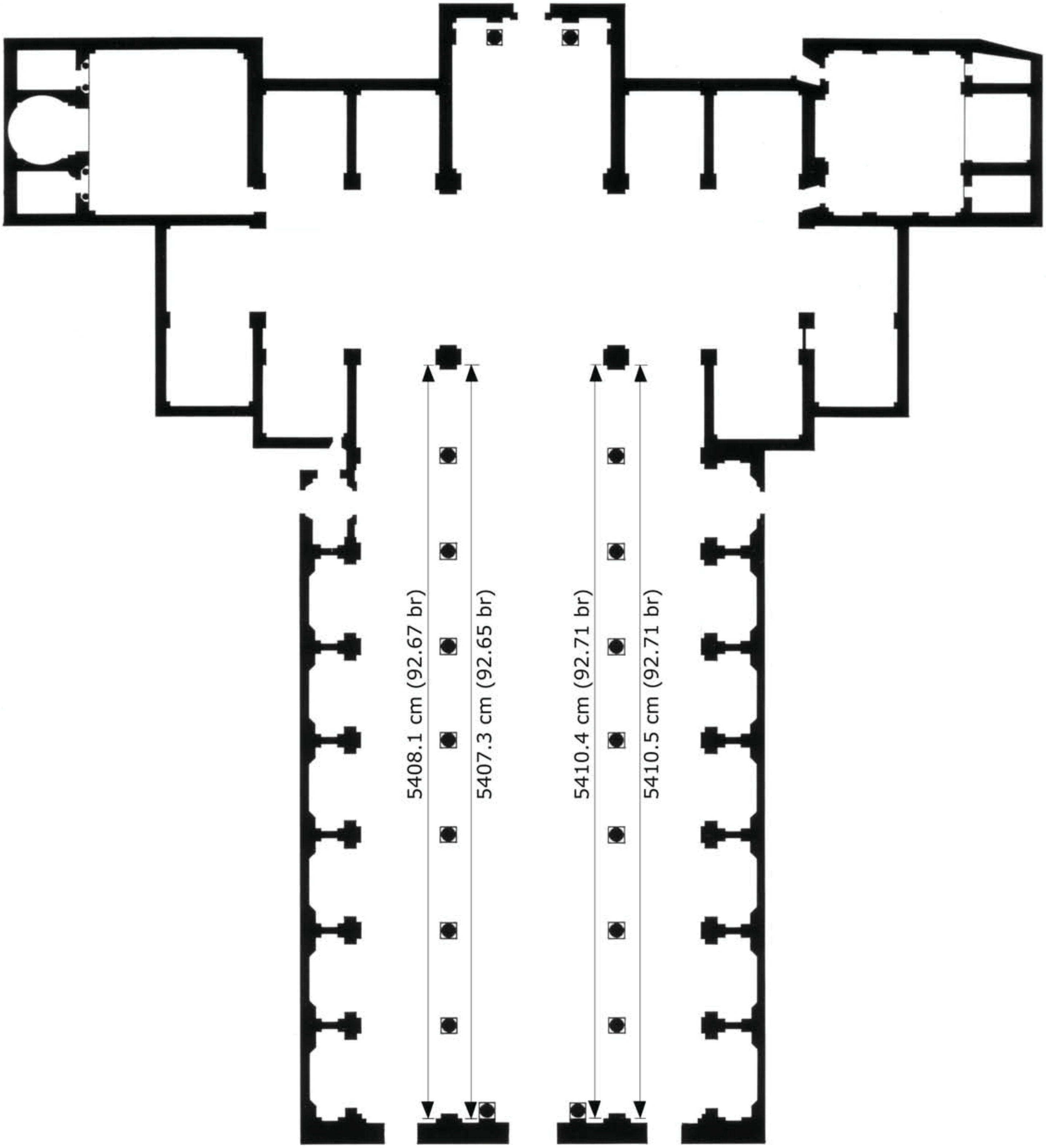


Figure 3-3. Basilica of San Lorenzo. Nave lengths measured plinth to plinth, in single tape measure readings.

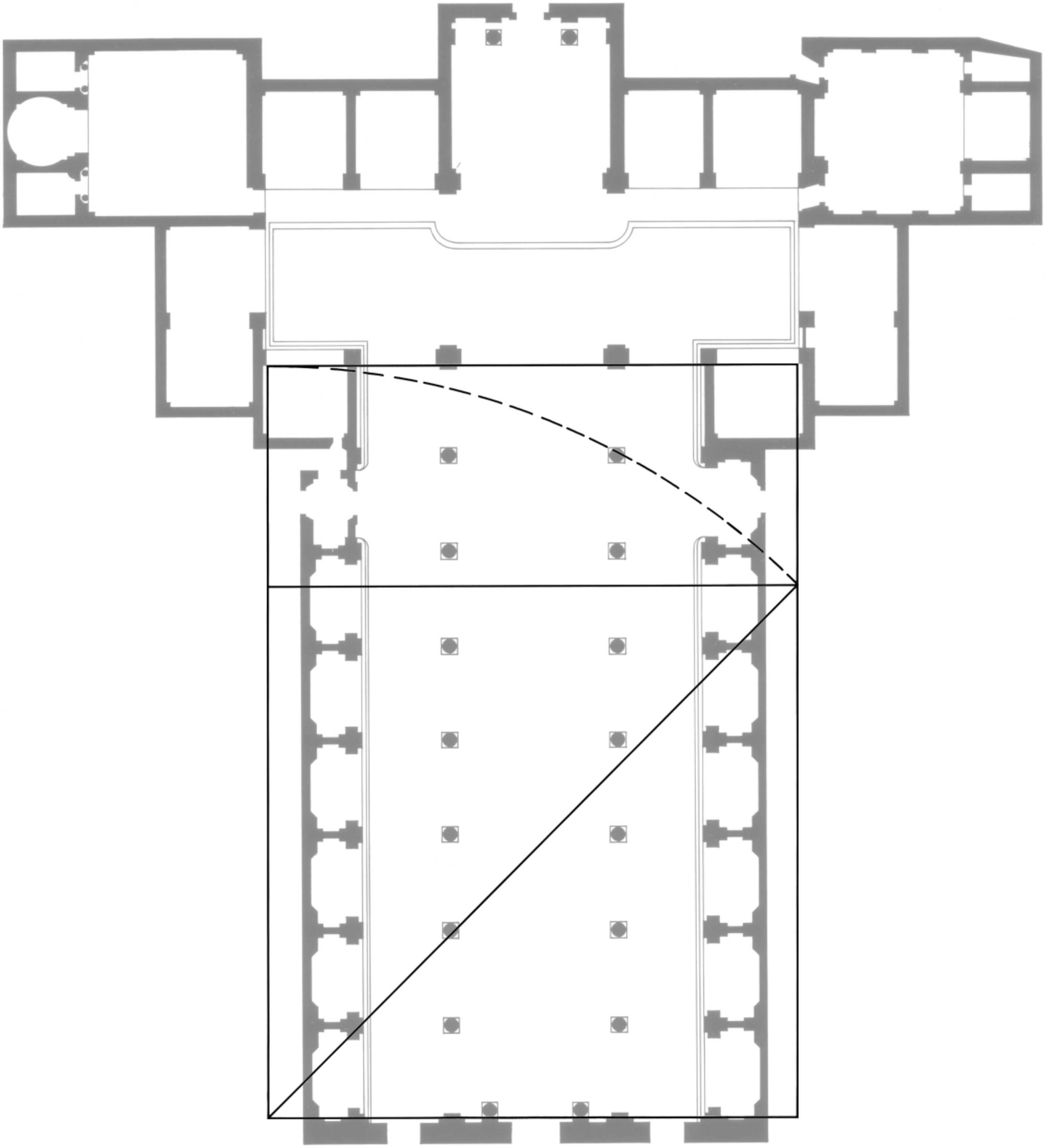


Figure 3-4. Basilica of San Lorenzo, floor plan with overlay showing nave proportions closely approximating those of a root-2 rectangle.

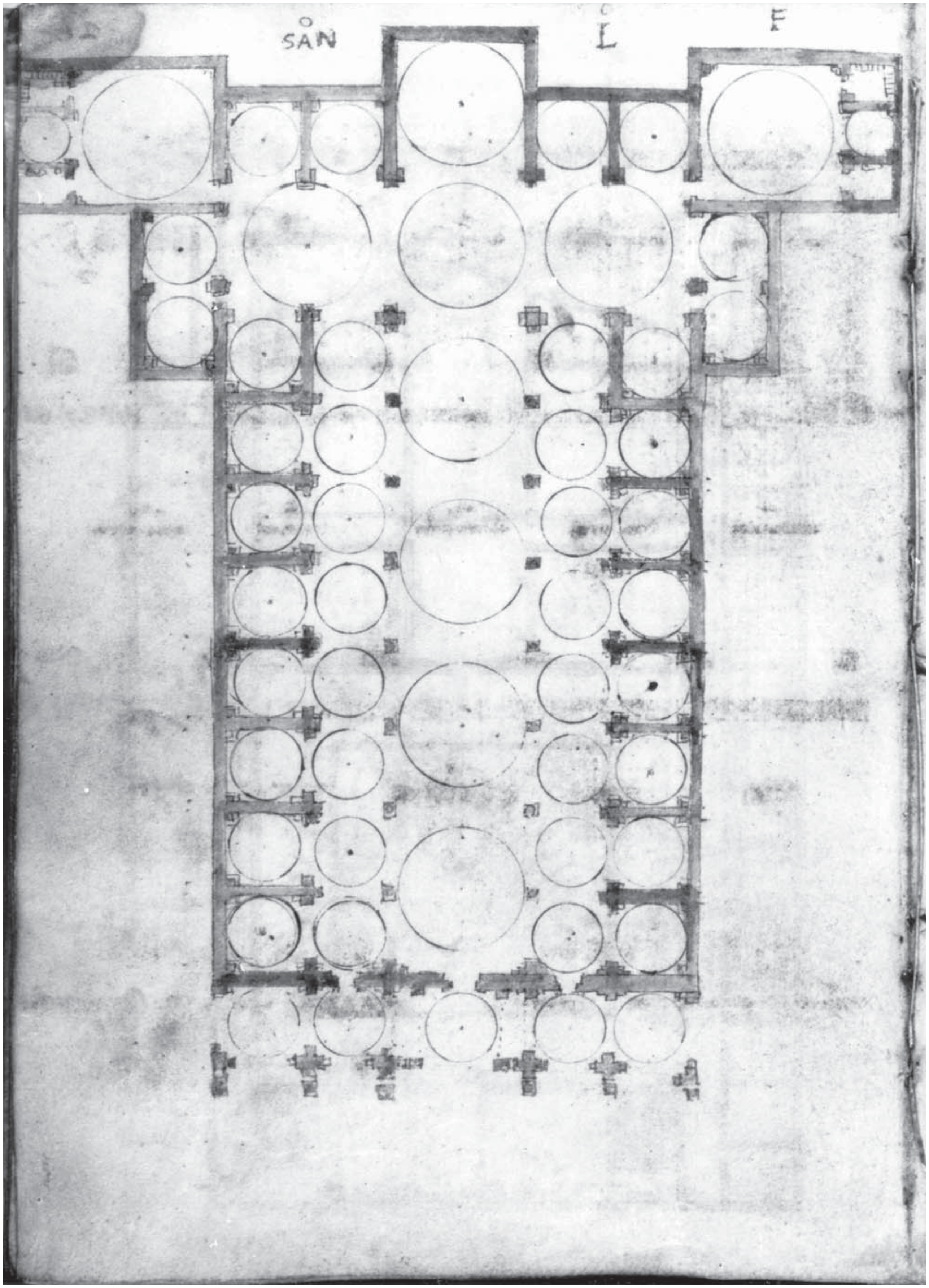


Figure 3-5. Giuliano da Sangallo, Basilica of San Lorenzo floor plan sketch, “Tacuino senese” (c. 1480).

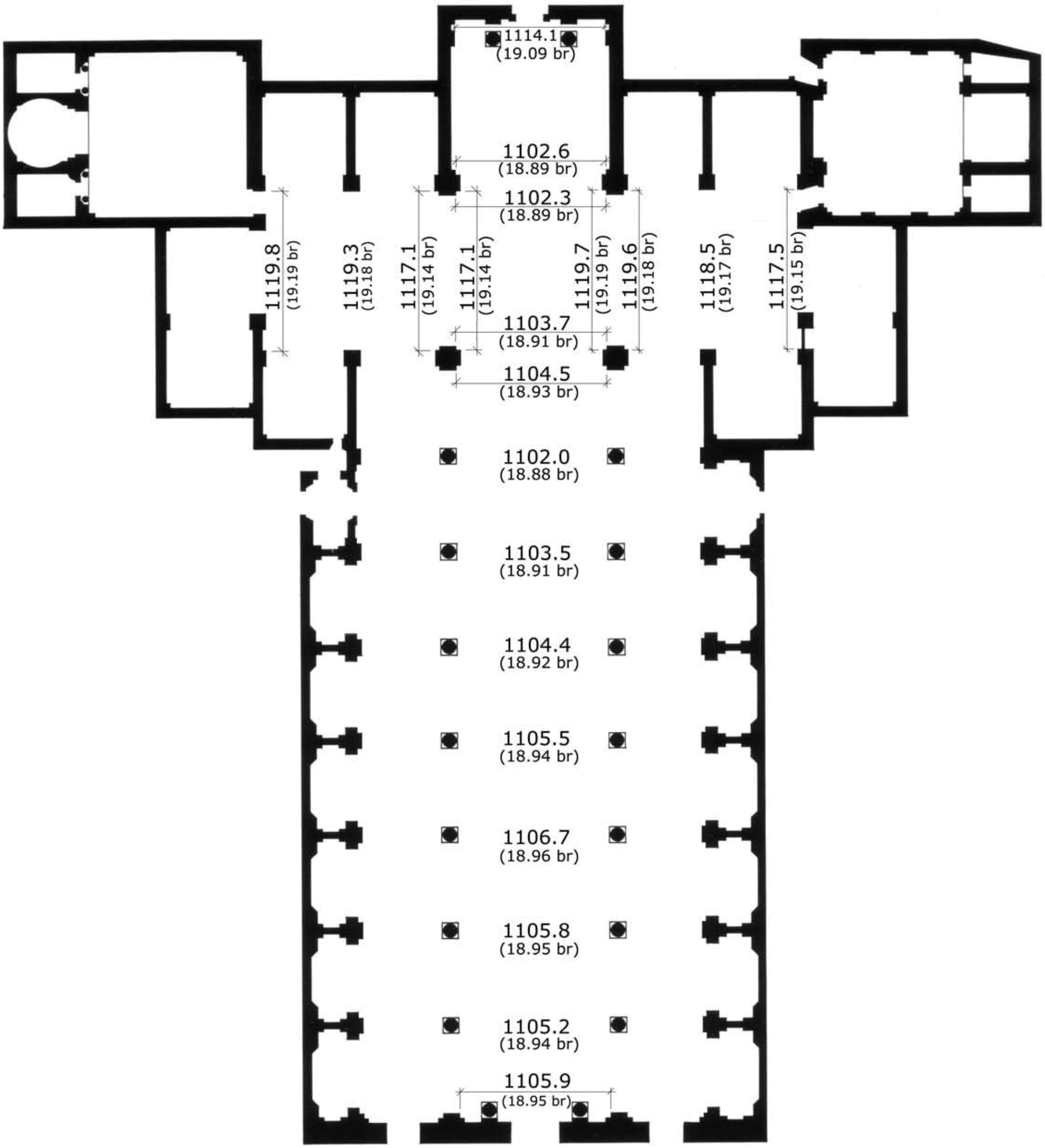


Figure 3-6. Basilica of San Lorenzo. Central spine widths, measured plinth to plinth. All measurements in cm except as noted.

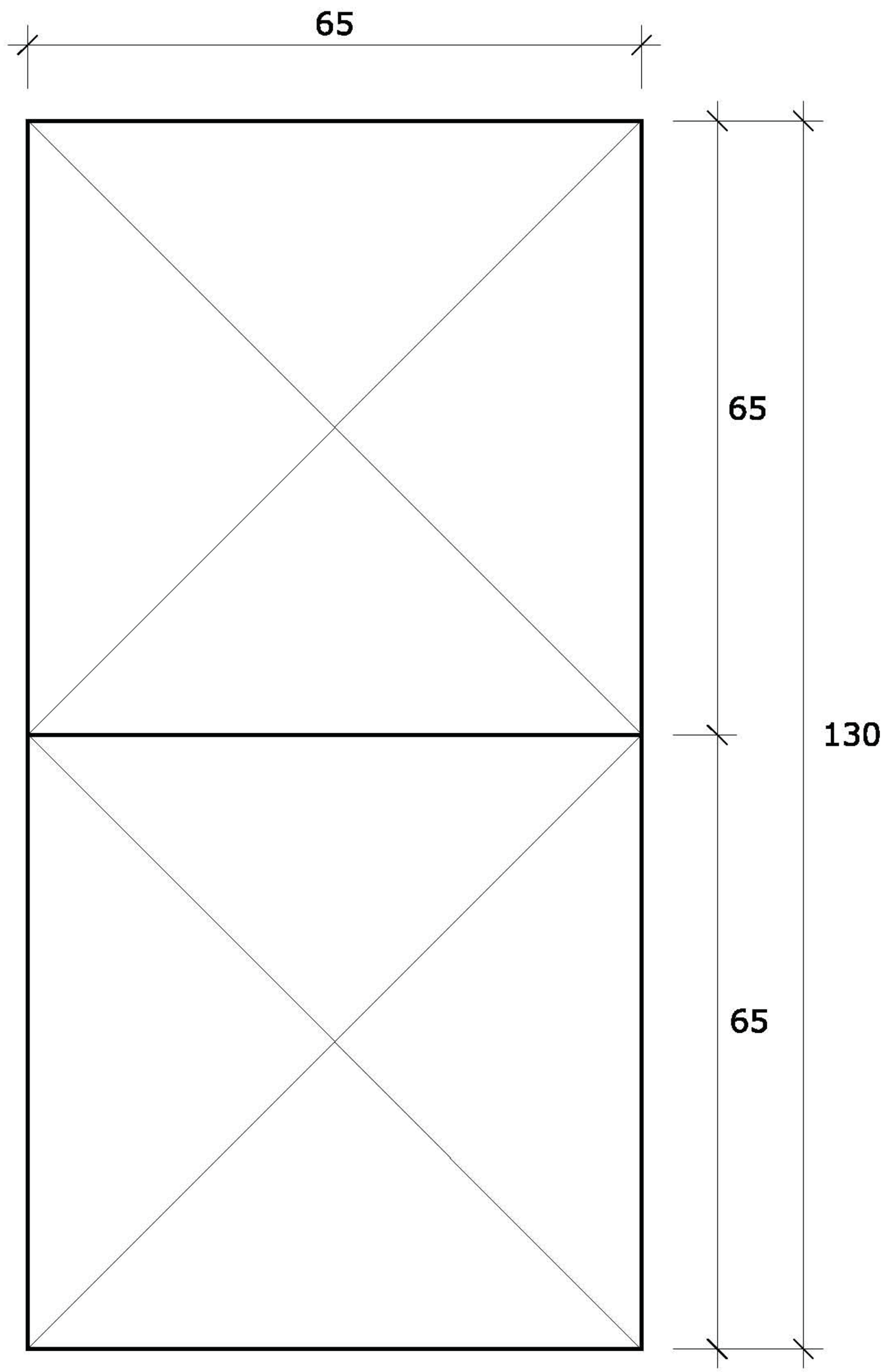


Figure 3-7. Basilica of San Lorenzo. Hypothetical reconstruction of the design process, Step 1: Compose Schematic Diagram.

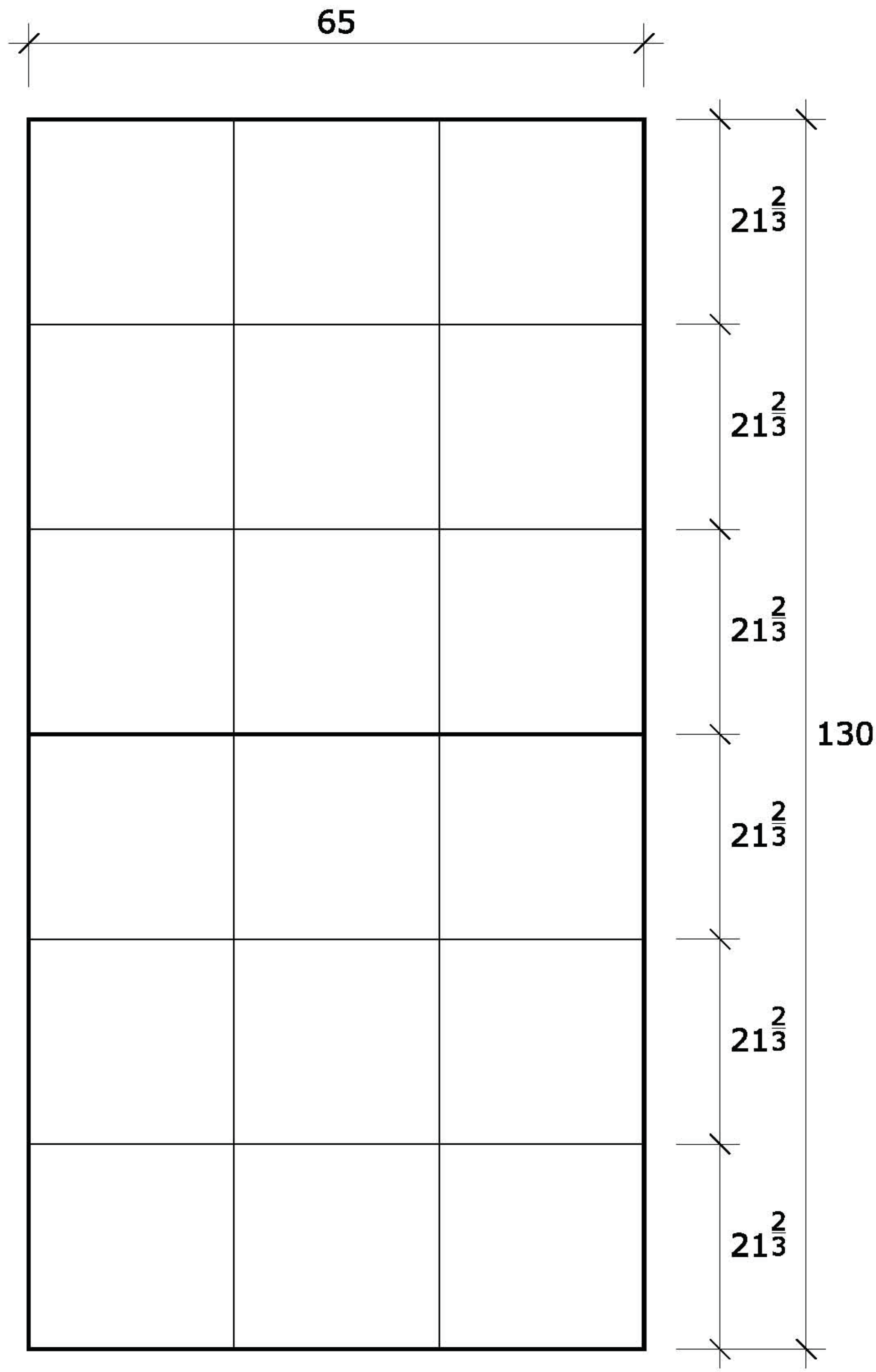


Figure 3-8. Basilica of San Lorenzo. Hypothetical reconstruction of the design process, Step 2: First Subdivision of Schematic Diagram.

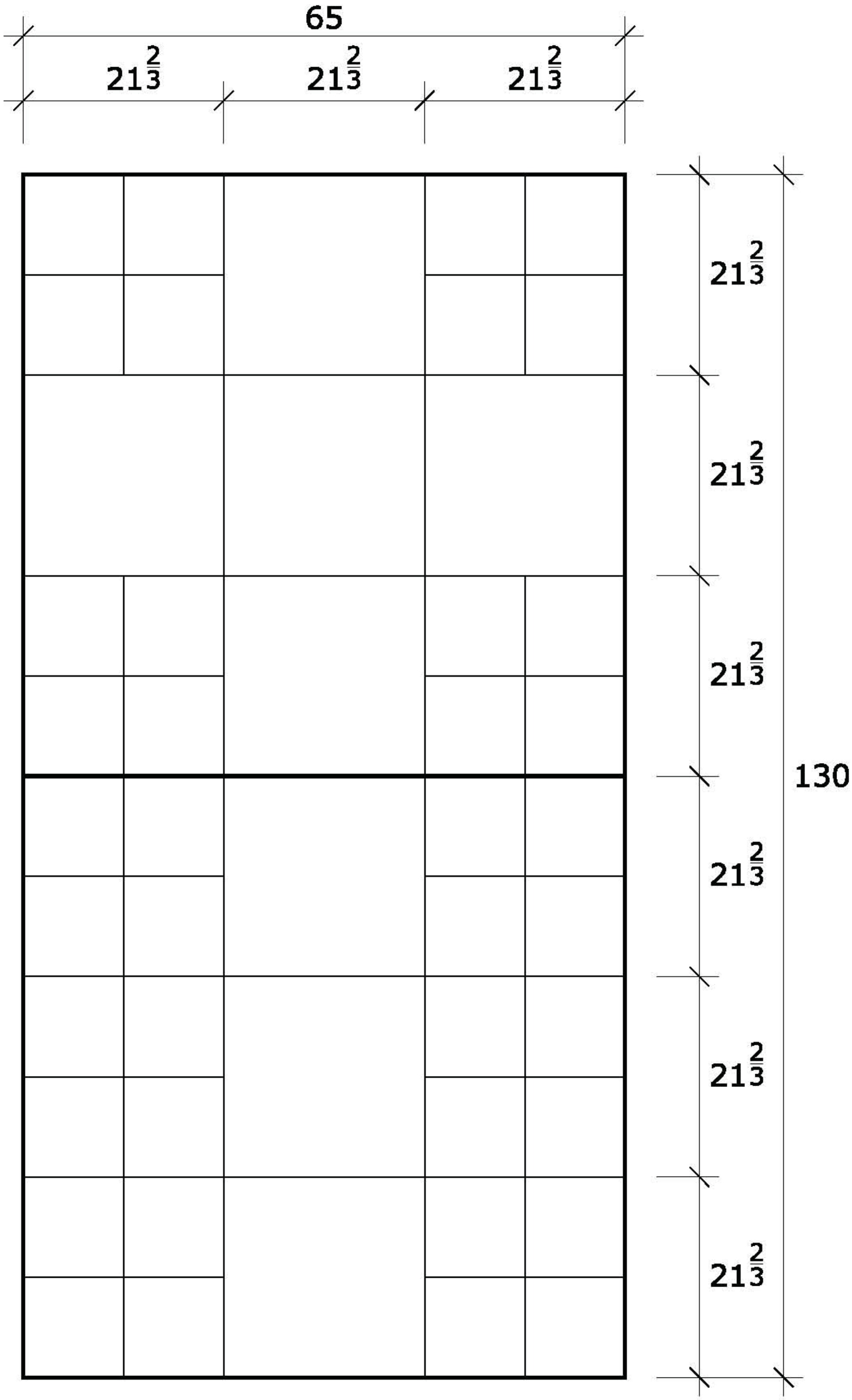


Figure 3-9. Basilica of San Lorenzo. Hypothetical reconstruction of the design process, Step 3: Second Subdivision of Schematic Diagram.

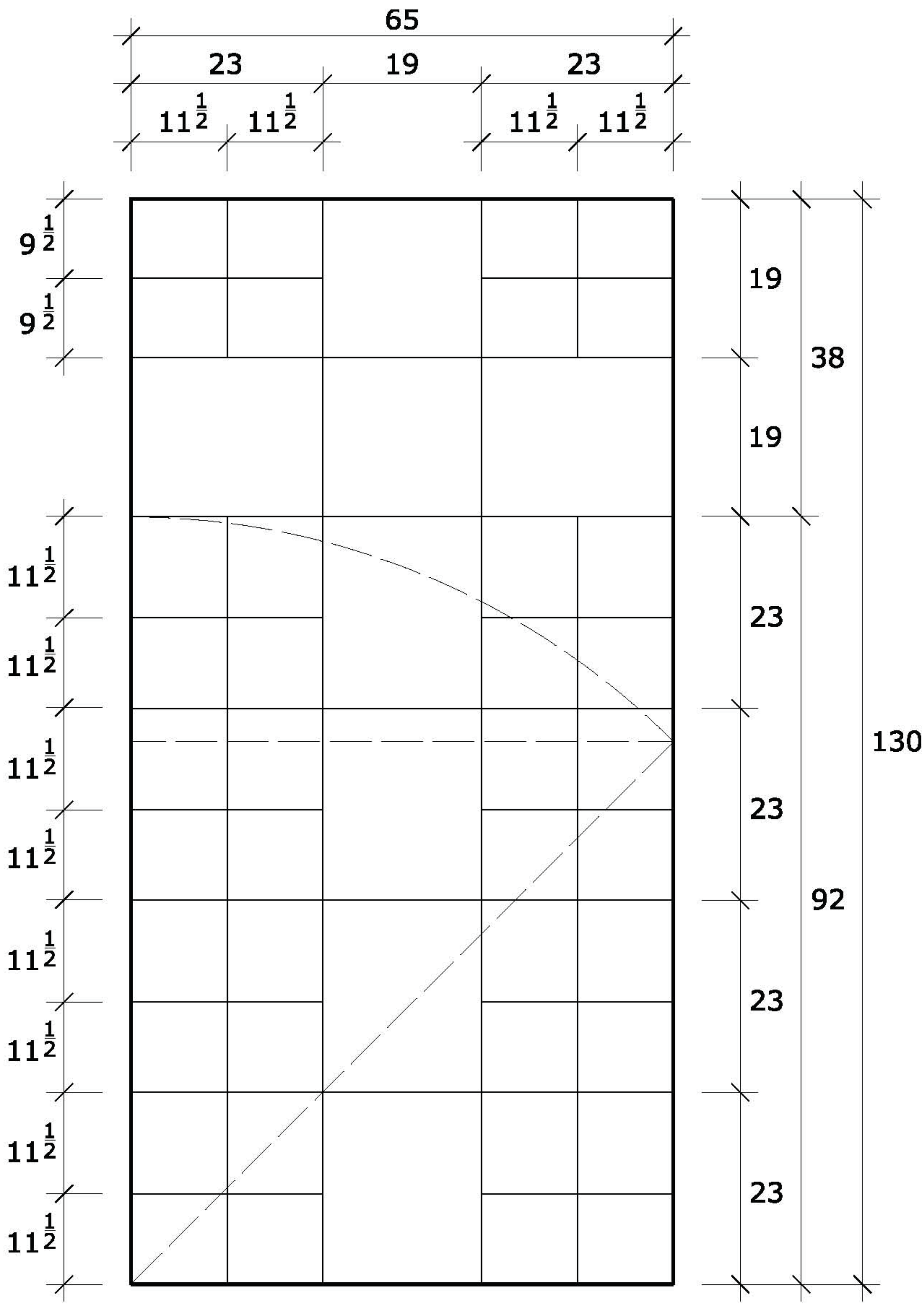


Figure 3-10. Basilica of San Lorenzo. Hypothetical reconstruction of the design process, Step 4: Incorporate Dimensions from the 65 Group.

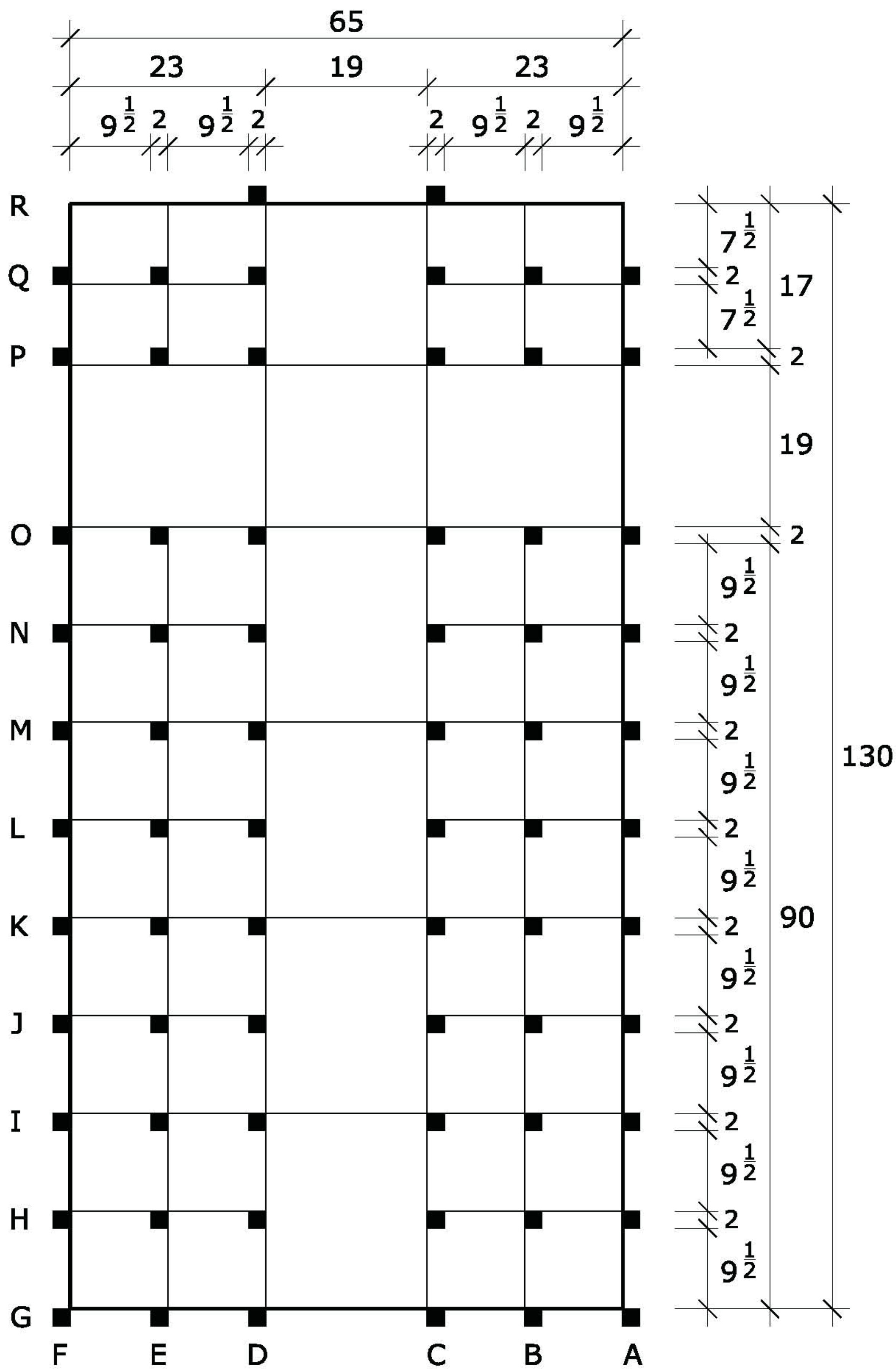


Figure 3-11. Basilica of San Lorenzo, hypothetical reconstruction of the design process, Step 5: Insert Column Plinths and Crossing Pier Cores.

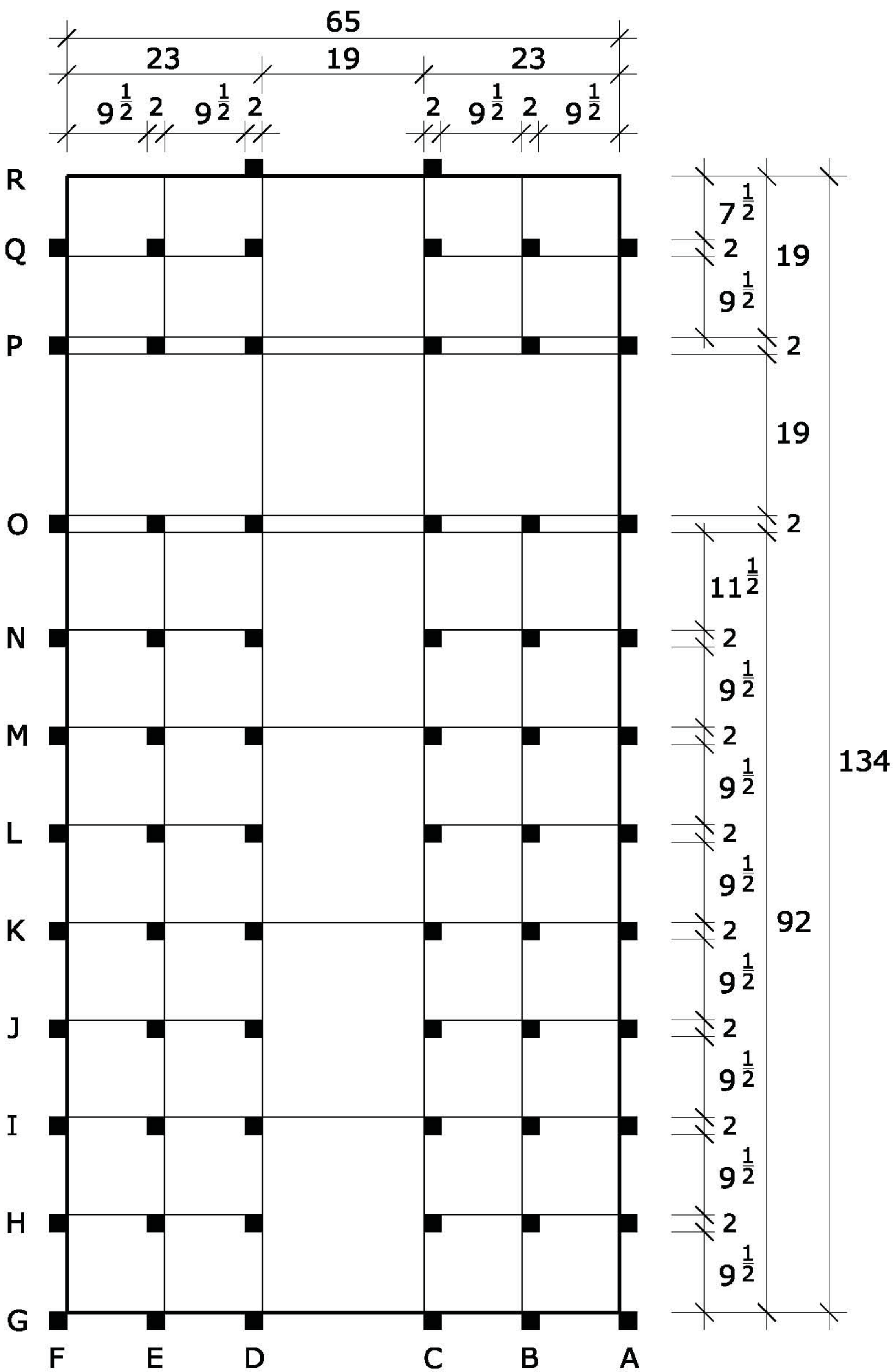


Figure 3-12. Basilica of San Lorenzo, hypothetical reconstruction of the design process, Step 6: Break Schematic Diagram into Three Parts.

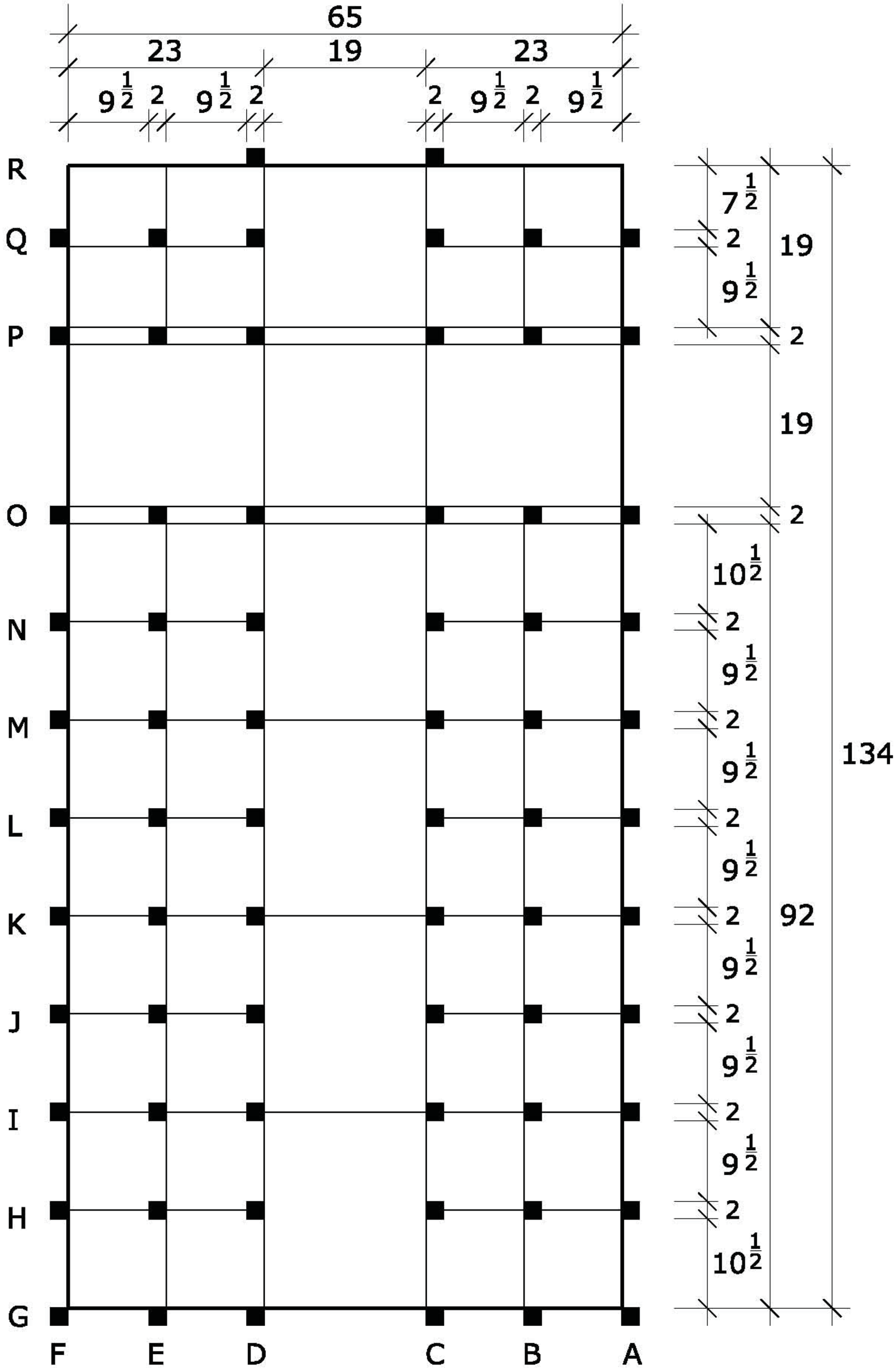


Figure 3-13. Basilica of San Lorenzo, hypothetical reconstruction of the design process, Step 7: Shift Cylindrical and Square Nave Columns 1 br Toward the Transept.

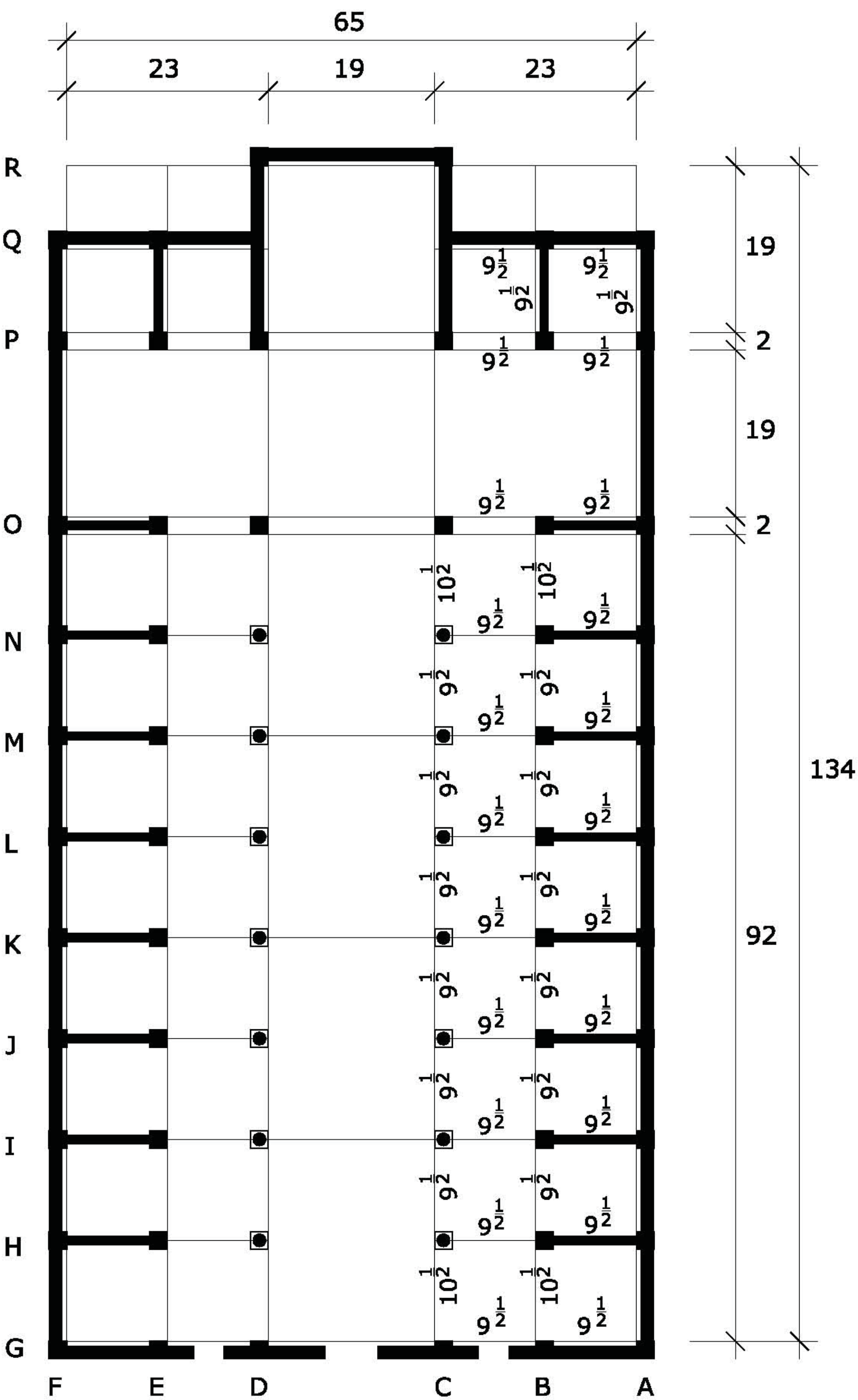


Figure 3-14. Basilica of San Lorenzo, hypothetical reconstruction of the design process, Step 8: Insert Walls.

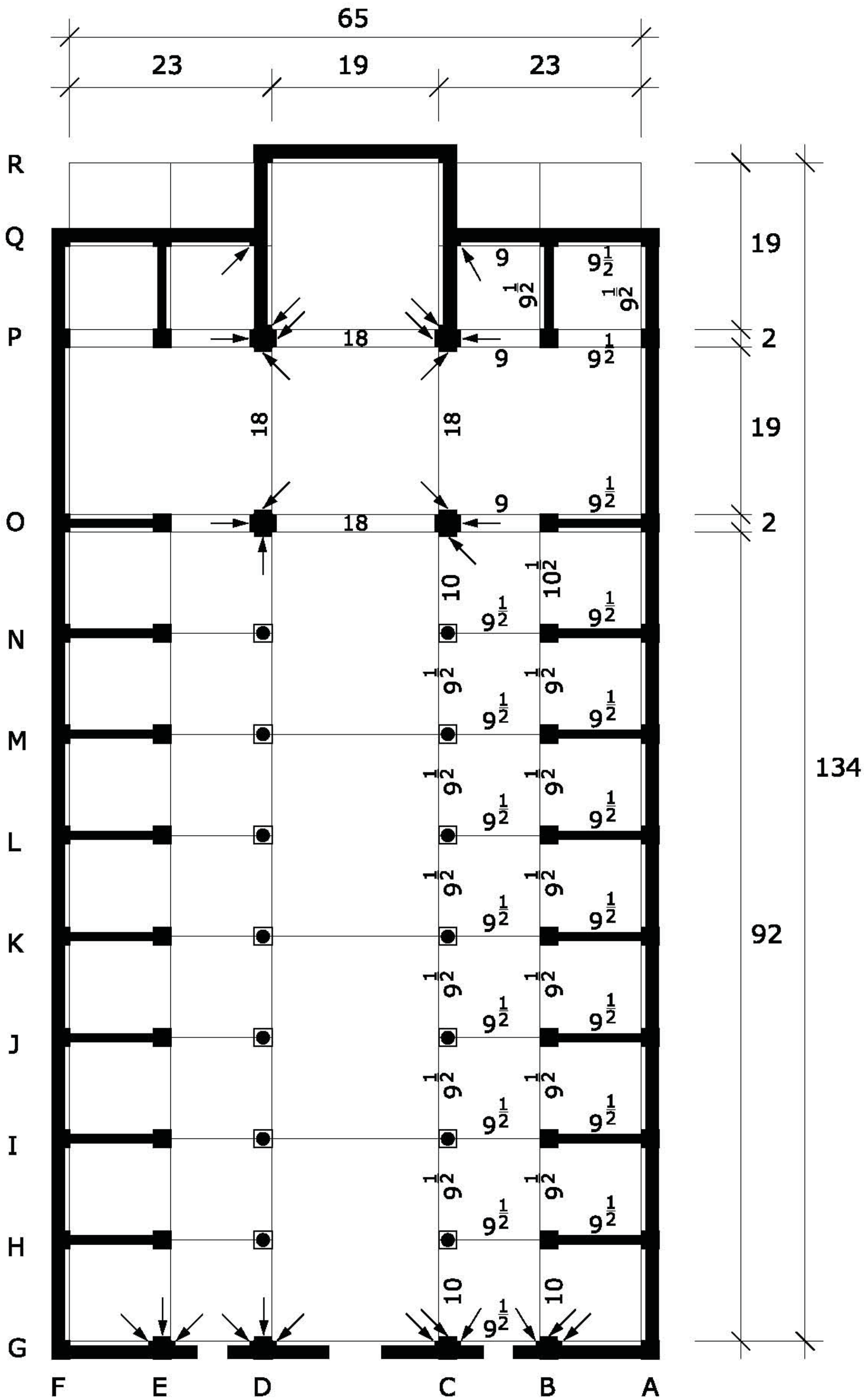


Figure 3-15. Basilica of San Lorenzo, hypothetical reconstruction of the design process, Step 9: Insert Crossing Pilasters and Miscellaneous Pilasters (indicated by arrows).

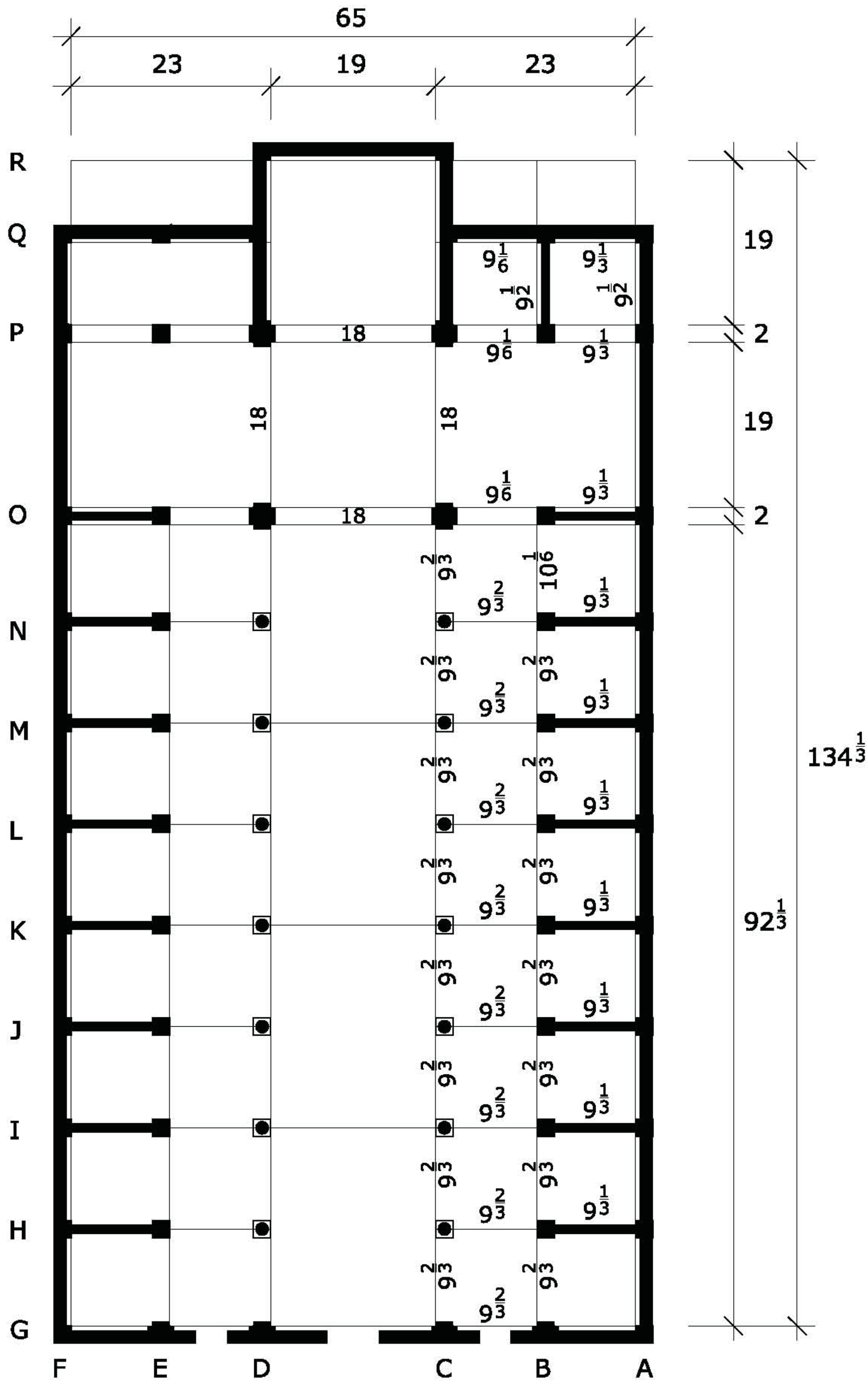


Figure 3-16. Basilica of San Lorenzo, hypothetical reconstruction of the design process, Step 10: Insert Nave Arcade Proportional System.

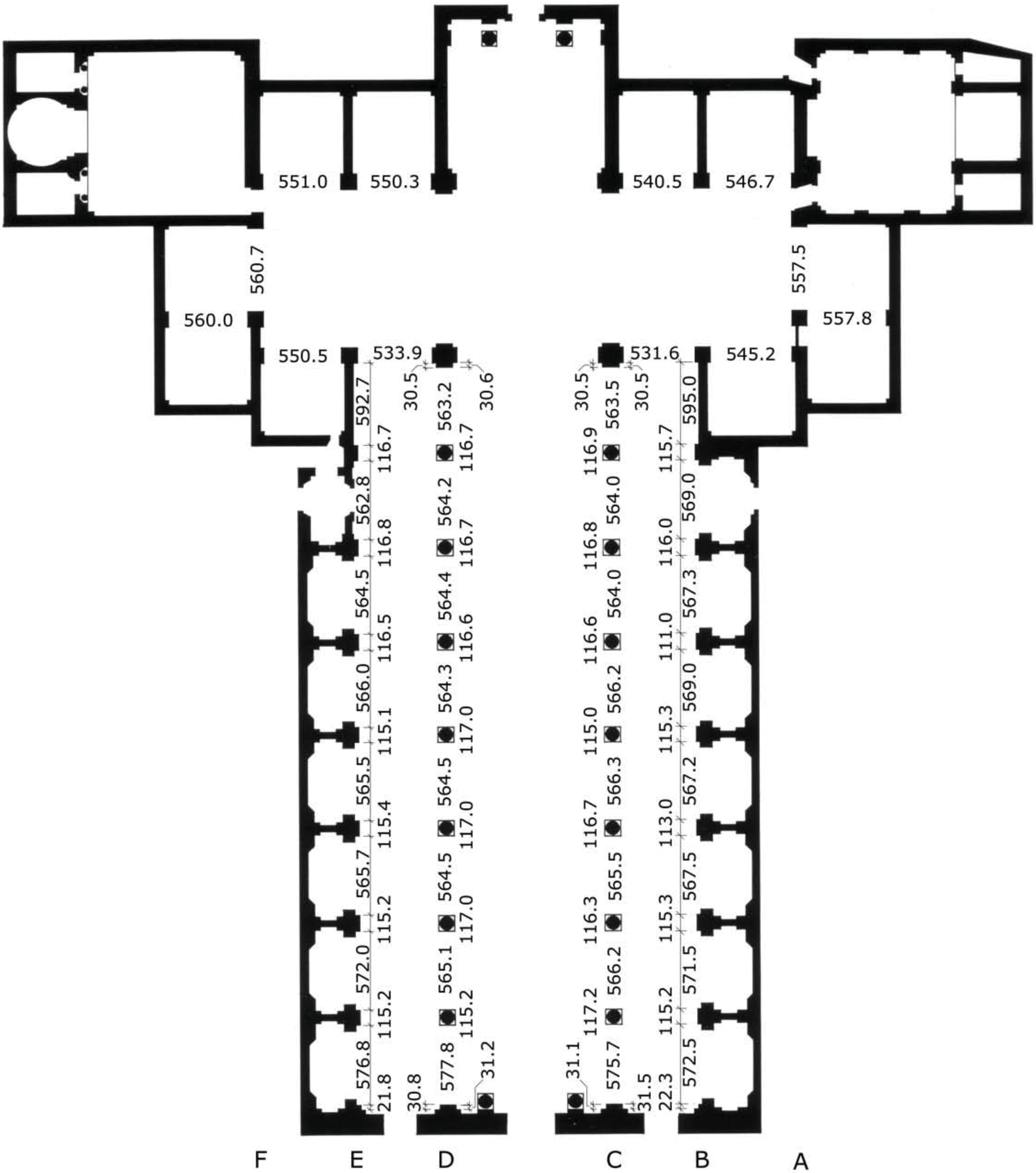


Figure 3-17. Basilica of San Lorenzo. Measurements pertaining to the nave length and transept chapel openings. All measurements in cm, and recorded plinth to plinth.

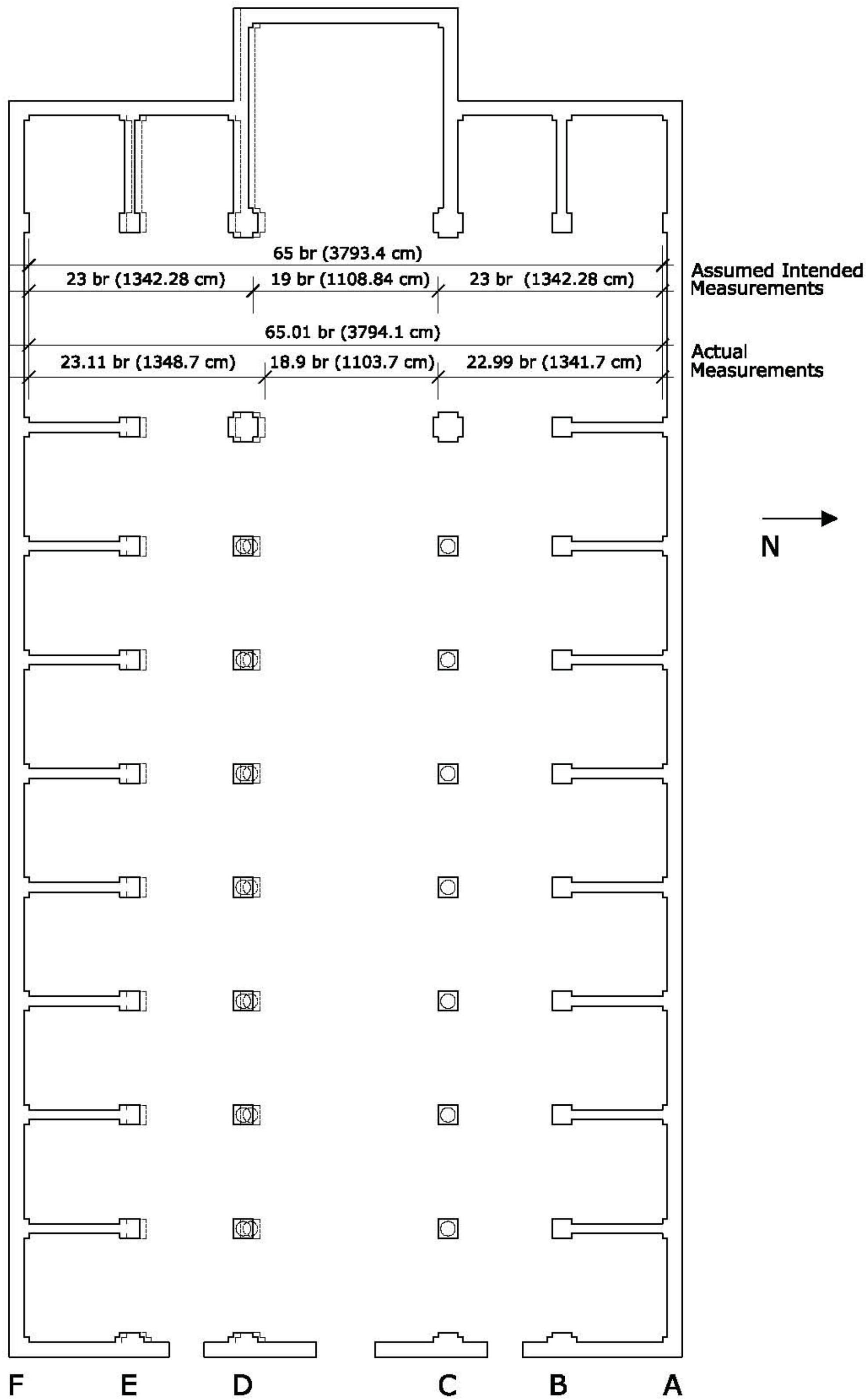


Figure 3-18. Basilica of San Lorenzo. Analysis of Floor Plan Discrepancy #1: Central Spine Width and Transept Arm Asymmetry.

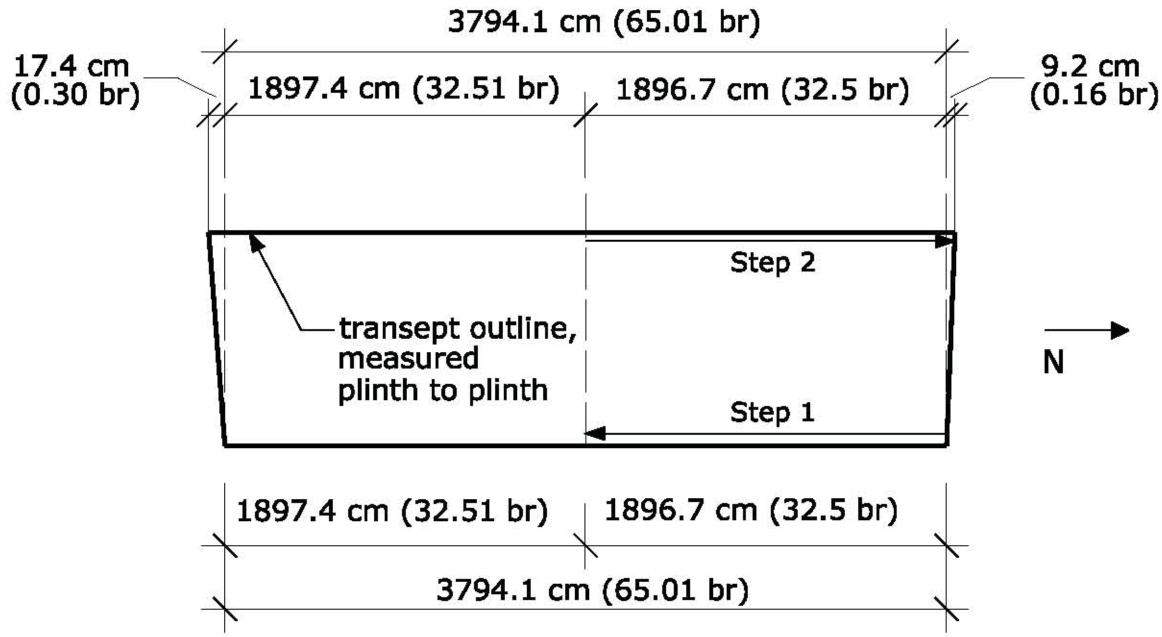
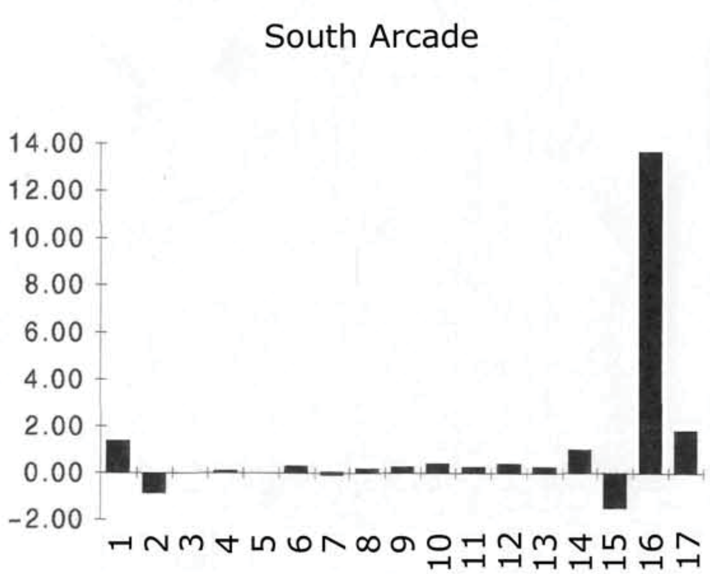


Figure 3-19. Basilica of San Lorenzo. Analysis of transept width irregularity (transept splaying shown is exaggerated).

EXPECTED NAVE LENGTH			ACTUAL NAVE LENGTHS					
Dimension	Br.	Cm.	Dimension	Cm.	Deviation	Dimension	Cm.	Deviation
Nave Length	92 1/3	5388.6	South	5407.3	**18.7**	North	5410.4	**21.8**

	EXPECTED COMPONENT DIMENSIONS			ACTUAL COMPONENT DIMENSIONS					
	Both Arcades			South Arcade			North Arcade		
	Dimension	Br.	Cm.	Dimension	Cm.	Discrepancy	Dimension	Cm.	Discrepancy
1	FP Plinth	1/2	29.2	FP 4	30.6	1.4	FP 7	30.5	1.3
2	Plinth-to-Plinth	9 2/3	564.1		563.2	-0.9		563.5	-0.6
3	Column Plinth	2	116.7	Column 7	116.7	0.0	Column 8	116.9	0.2
4	Plinth-to-Plinth	9 2/3	564.1		564.2	0.1		564.0	-0.1
5	Column Plinth	2	116.7	Column 6	116.7	0.0	Column 9	116.8	0.1
6	Plinth-to-Plinth	9 2/3	564.1		564.4	0.3		564.0	-0.1
7	Column Plinth	2	116.7	Column 5	116.8	0.1	Column 10	116.7	0.0
8	Plinth-to-Plinth	9 2/3	564.1		564.3	0.2		566.2	2.1
9	Column Plinth	2	116.7	Column 4	117.1	0.4	Column 11	115.4	-1.3
10	Plinth-to-Plinth	9 2/3	564.1		564.5	0.4		566.3	2.2
11	Column Plinth	2	116.7	Column 3	117.0	0.3	Column 12	115.4	-1.3
12	Plinth-to-Plinth	9 2/3	564.1		564.5	0.4		565.5	1.4
13	Column Plinth	2	116.7	Column 2	116.9	0.2	Column 13	116.4	-0.3
14	Plinth-to-Plinth	9 2/3	564.1		565.1	1.0		566.2	2.1
15	Column Plinth	2	116.7	Column 1	115.5	-1.2	Column 14	117.2	0.5
16	Plinth-to-Plinth	9 2/3	564.1		577.8	13.7		575.7	11.6
17	FP Plinth	1/2	29.2	FP 2	30.8	1.6	FP 9	31.5	2.3
	TOTAL	92 1/3	5388.1	**TOTAL**	5406.1	**18.0**	**TOTAL**	5408.2	**20.1**
	Error:	0	0.5		1.2	0.7		2.2	1.7



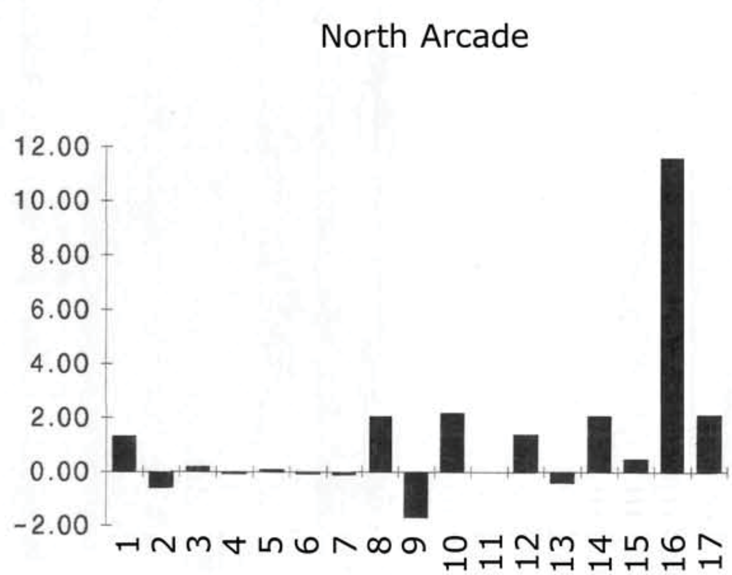


Figure 3-20. Basilica of San Lorenzo. Analysis of nave length discrepancies relative to reconstructed dimensions.

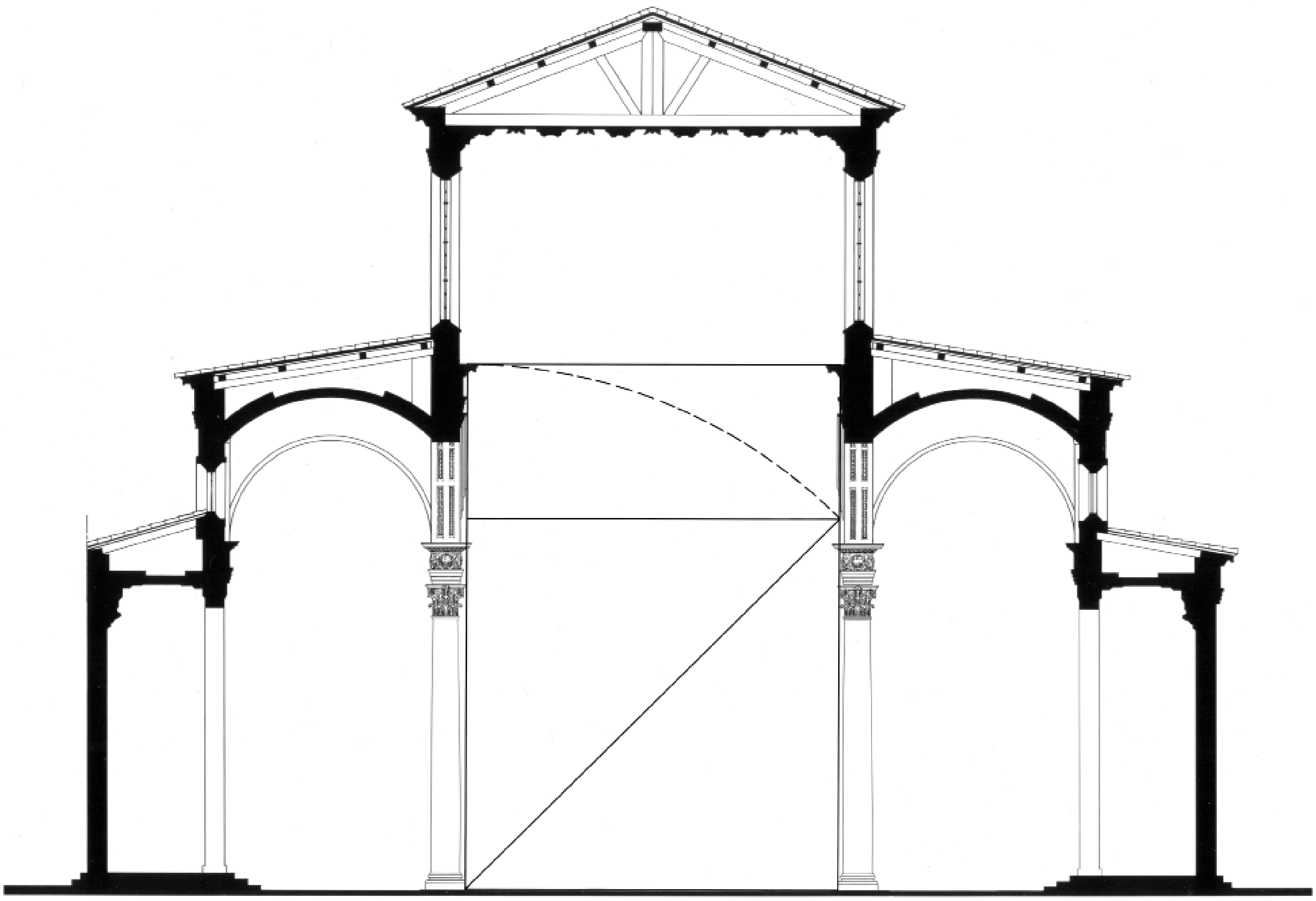


Figure 3-21. Basilica of San Lorenzo, nave cross-section with overlay showing the proportions of a root-2 rectangle, measured plinth to plinth.

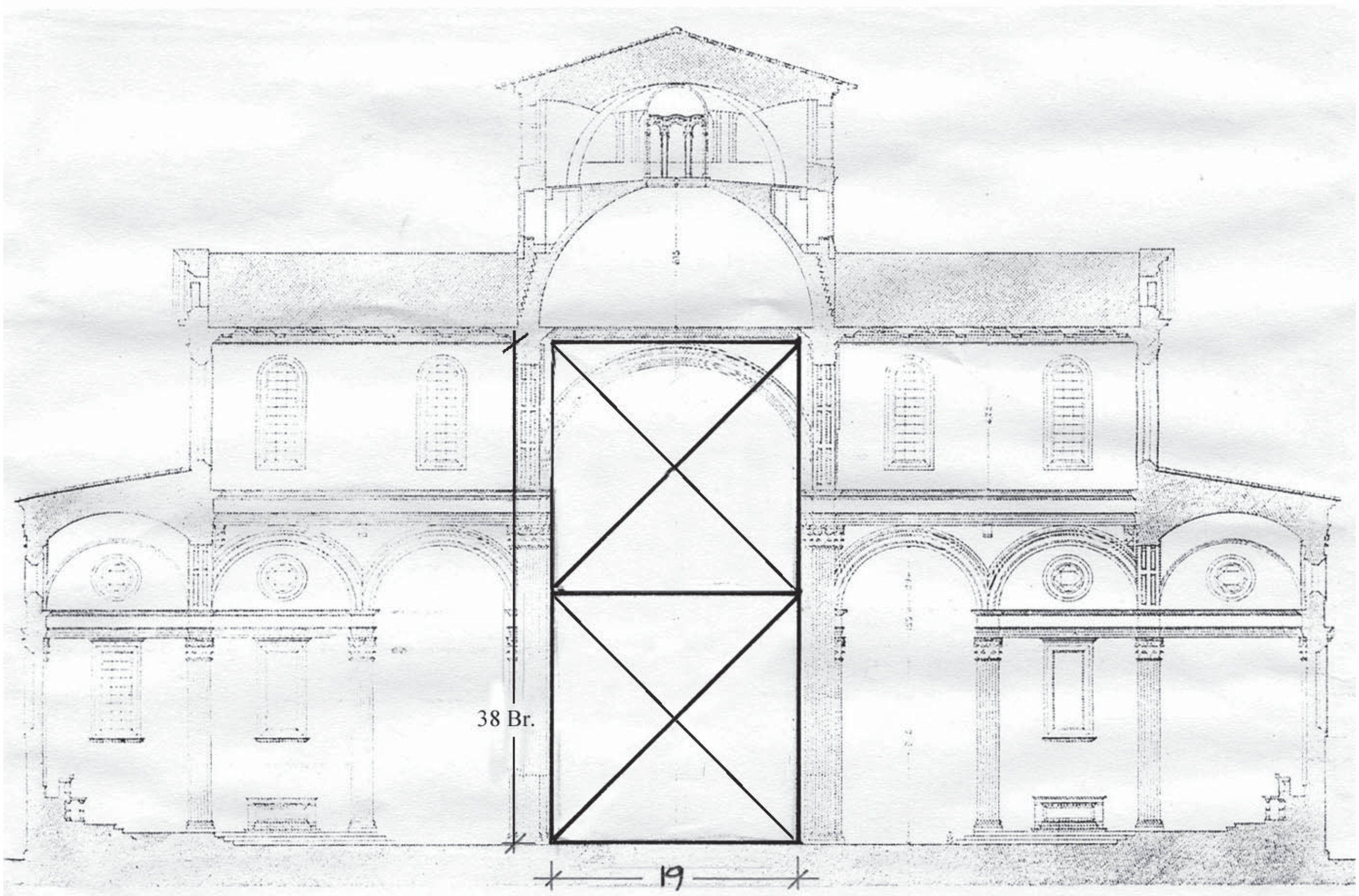


Figure 3-22. Basilica of San Lorenzo, nave cross-section with overlay showing the proportions of a two-square rectangle, measured plinth to plinth in width, and to the fascia in the middle of the crown molding in height (provisional drawing).

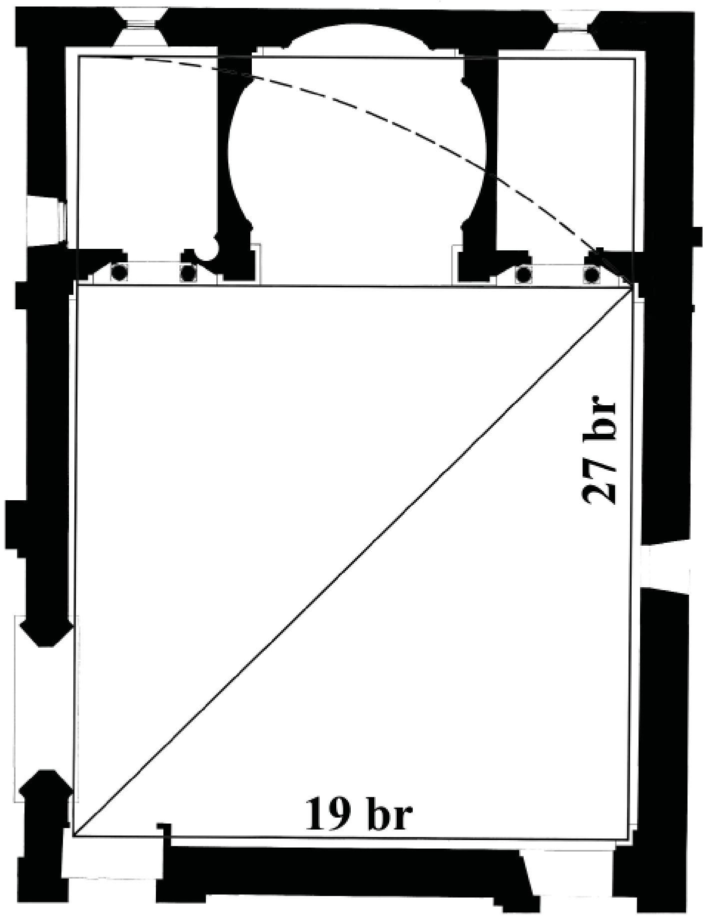


Figure 3-23. Old Sacristy, floor plan with overlay showing nave proportions closely approximating those of a root-2 rectangle.

Figure 3-24. Old Sacristy, main room dome (completed c.1428).

Figure 3-25. Basilica of San Lorenzo, crossing dome (completed c. 1457, with lantern rebuilt in 1742).

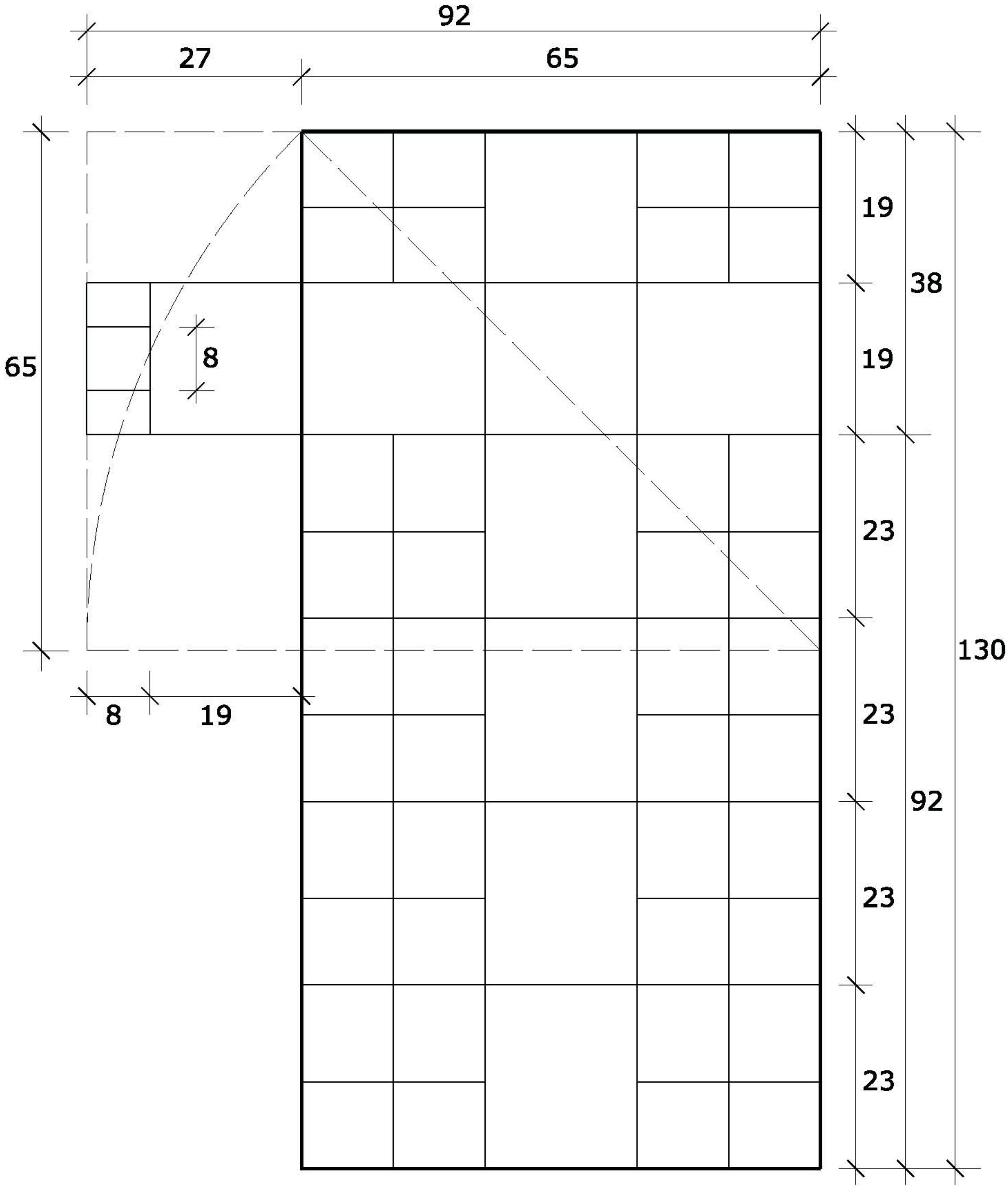


Figure 3-26. Basilica of San Lorenzo. Hypothetical reconstruction of the design process, Step 15: Derive Old Sacristy Proportions from Overall Basilica Proportions.

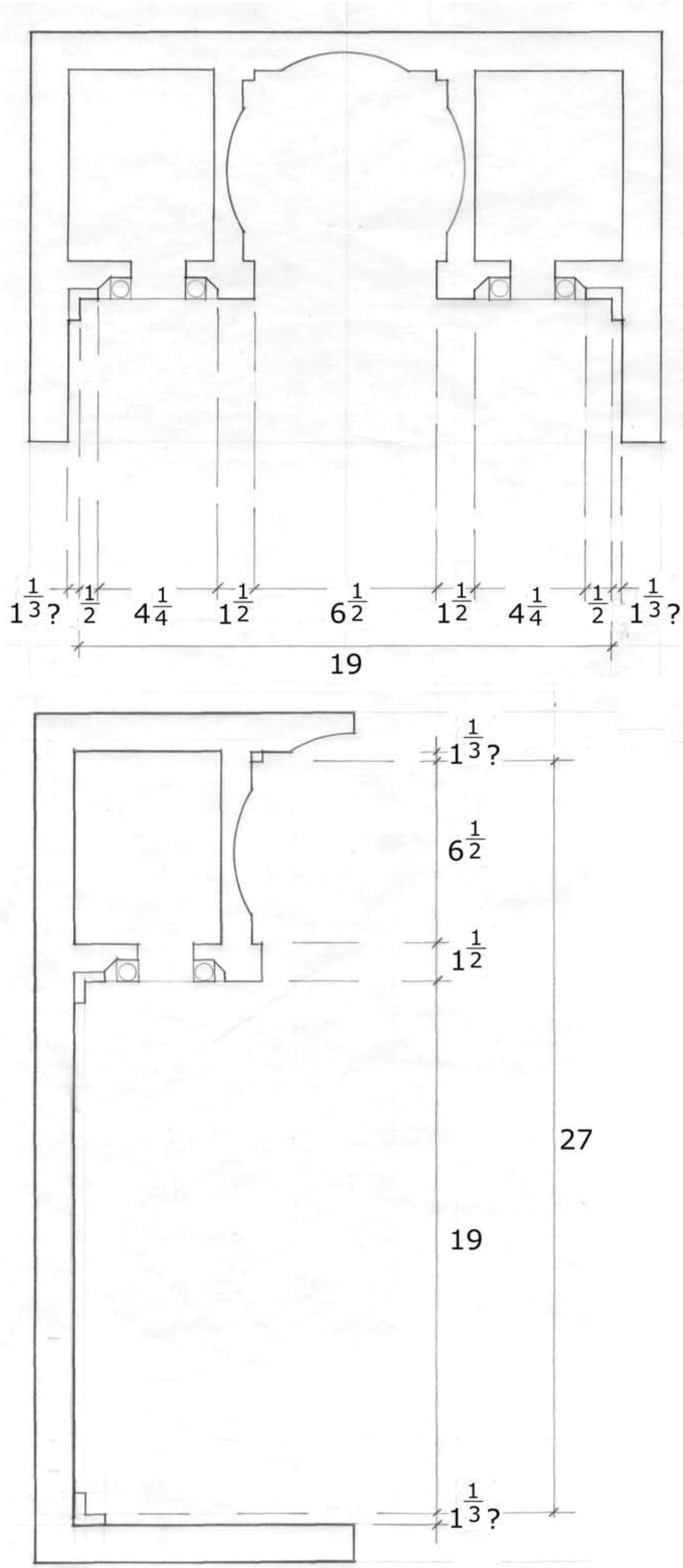


Figure 3-27. Basilica of San Lorenzo. Major Old Sacristy dimensions in br..

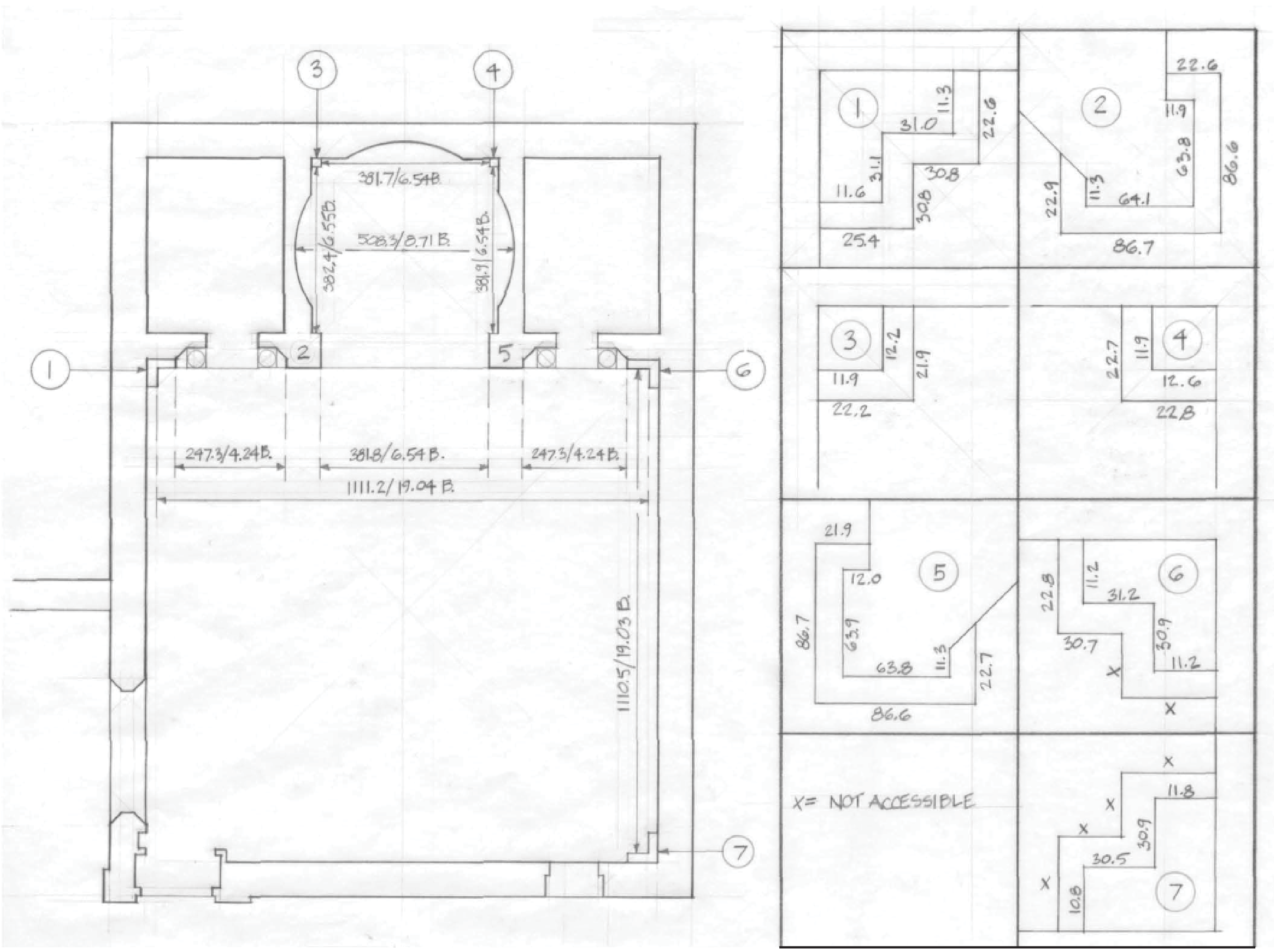


Figure 3-28. Basilica of San Lorenzo. Selected Old Sacristy field measurements.

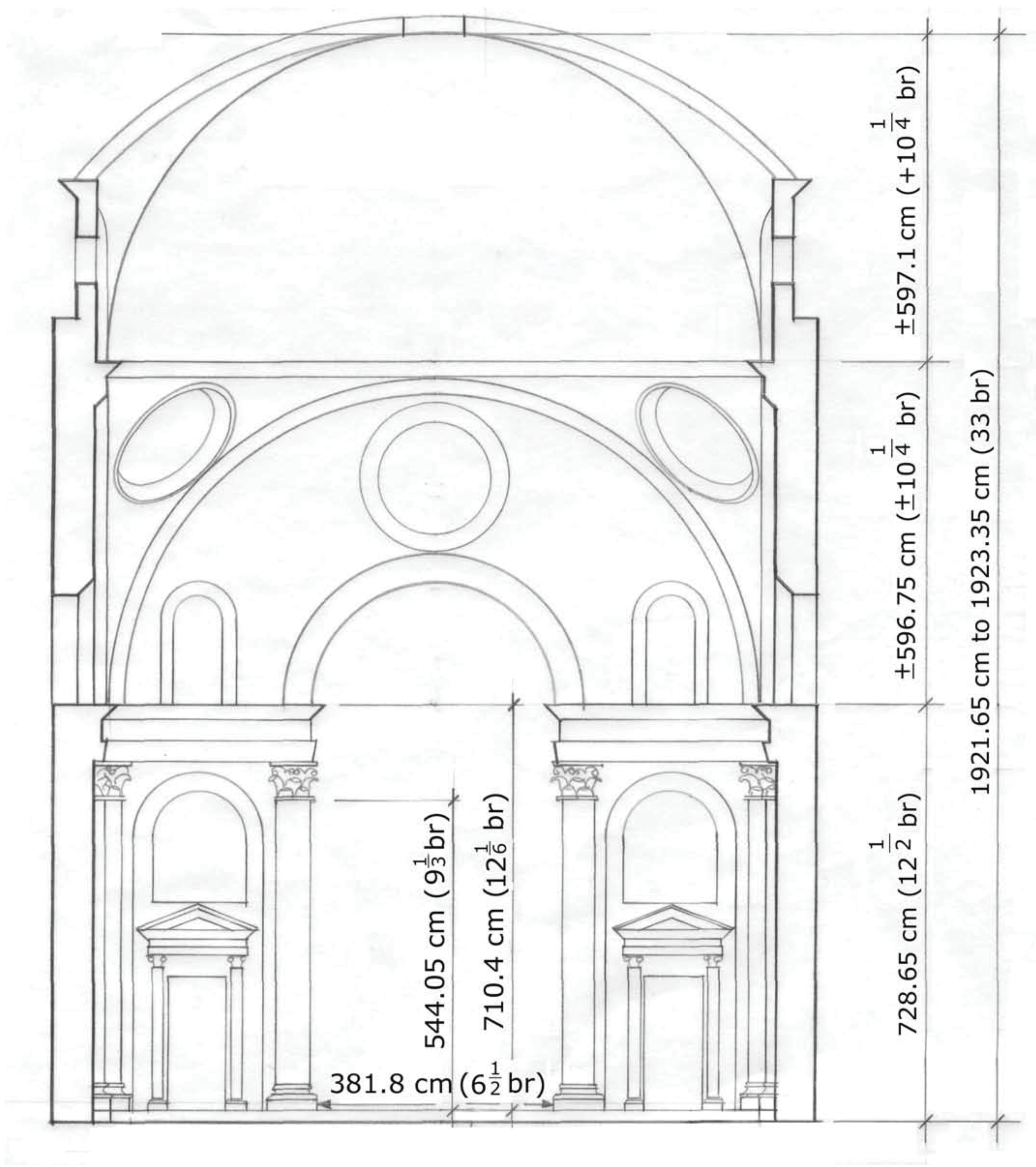


Figure 3-29. Basilica of San Lorenzo. Old Sacristy, major cross-section measurements.

Figure 3-30. Basilica of San Lorenzo. Entablature block frieze relief, Column 5, Side a.

Figure 3-31. Basilica of San Lorenzo. Entablature block frieze relief, Column 10, Side a.

Figure 3-32. Galleria dell'Accademia #17, Jacobello Alberegno, "Polittico dell' Apocalisse," c. 1360 to 1390 (cat. 1000).

Figure 3-33. Basilica of San Lorenzo. Exterior entablature frieze relief in terra cotta, surrounding the Old Sacrsity and Medici double chapel (Saalman).

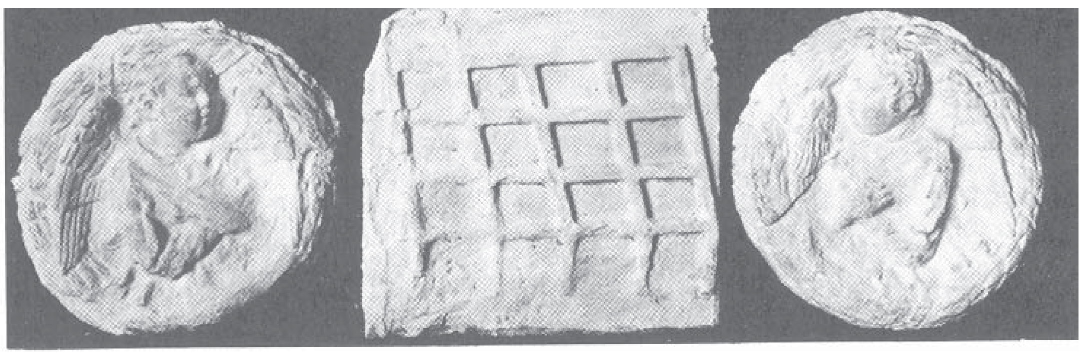


Figure 3-34. Basilica of San Lorenzo. Exterior entablature frieze relief in terra cotta, surrounding the Old Sacrsity and Medici double chapel, removed for conservation (Ruschi et al.).

Figure 3-35. Coat of arms of the Arte della lana, on the facade of no. 14 Via dei Servi.

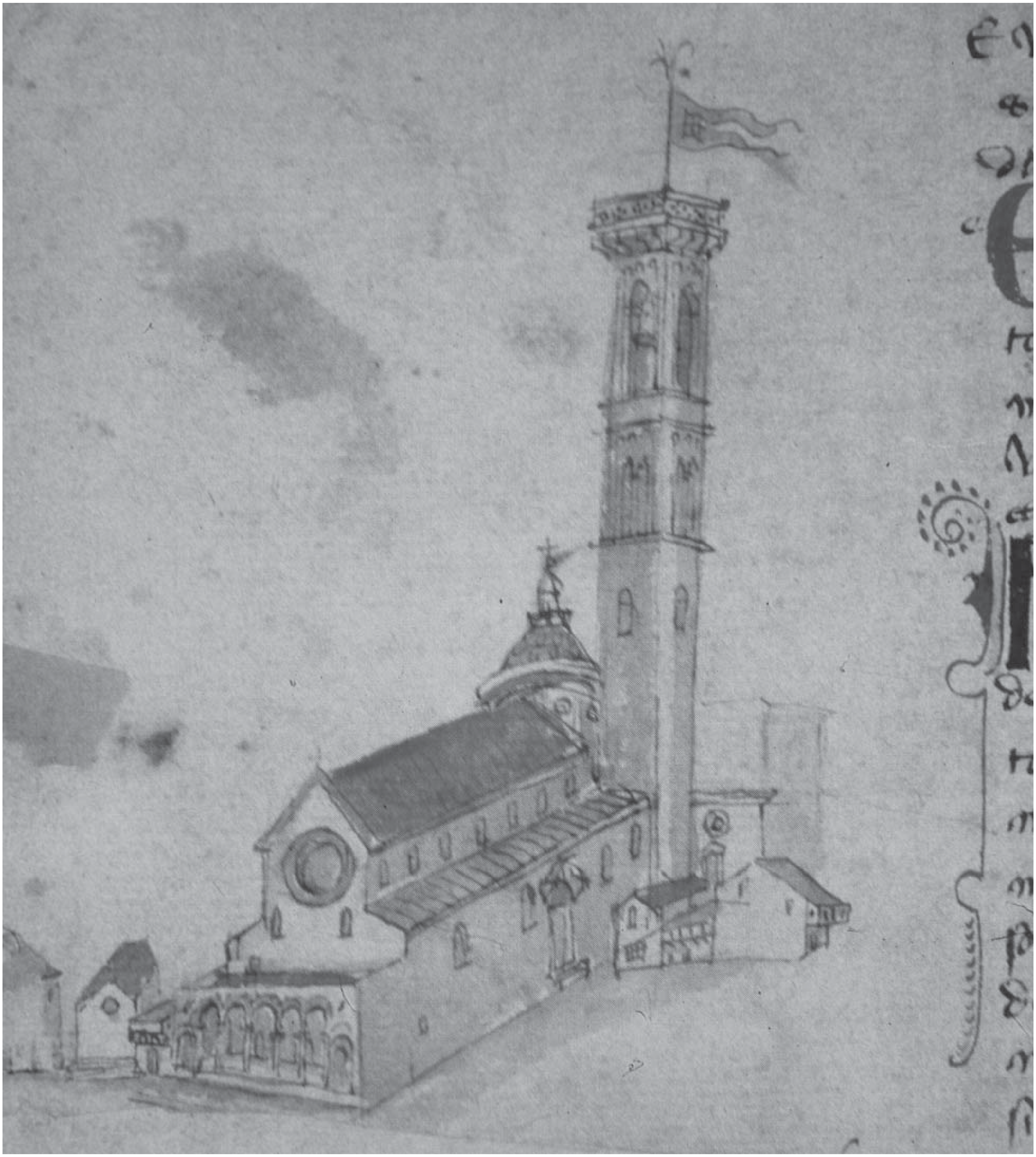


Figure 4-1. Old Basilica of San Lorenzo, Codex Rustici, c. 1444 (Seminario Archivescovile, Florence).

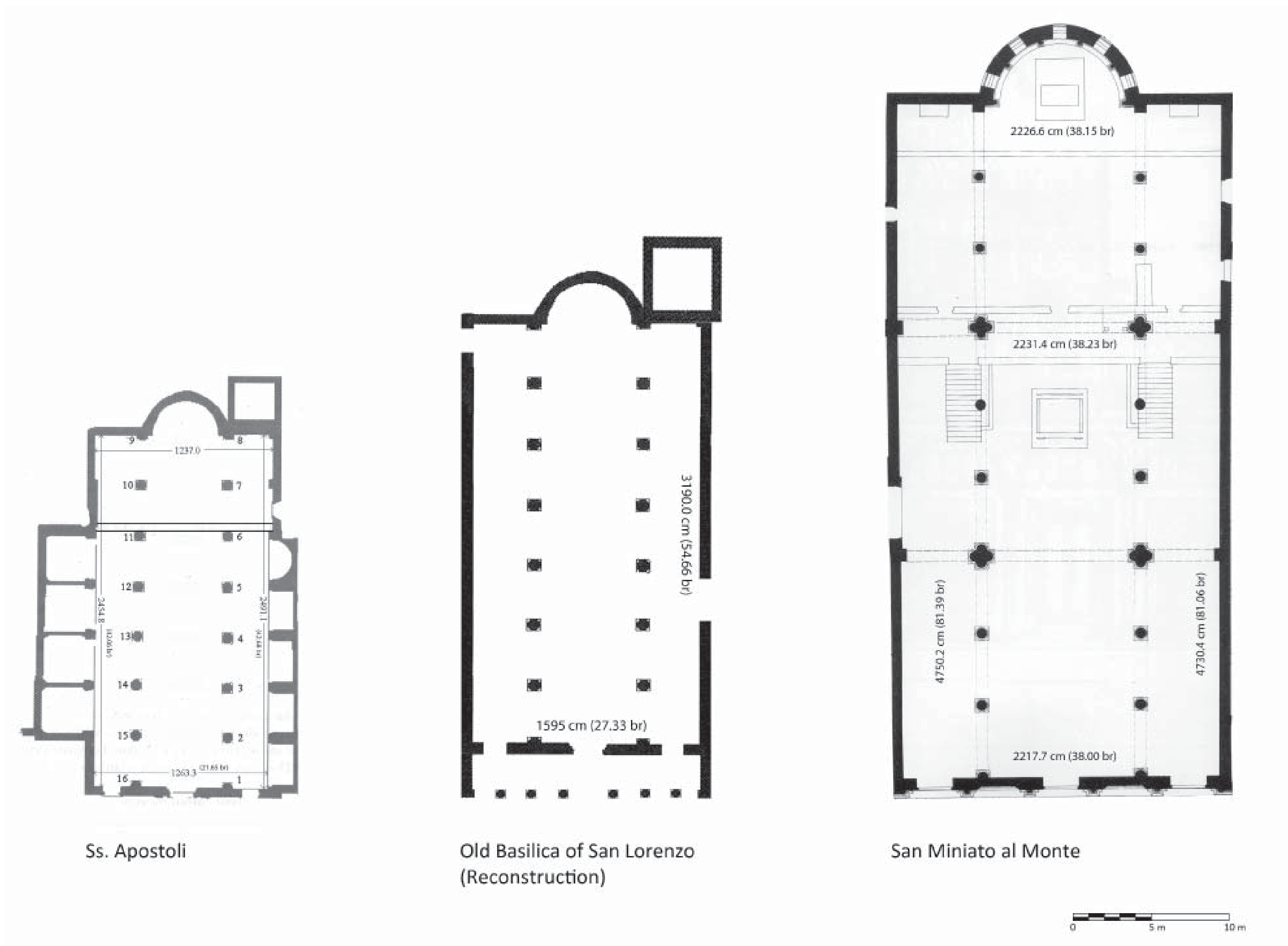


Figure 4-2. Comparative floor plans, drawn to scale: a) Basilica of Santi Apostoli, Florence, rebuilt in the eleventh century; b) Author's hypothetical reconstruction of the old Basilica of San Lorenzo, c. 1060; c) Basilica of San Miniato al Monte, c. 1018.

Figure 4-3. Basilica of Santi Apostoli, Florence, rebuilt in the eleventh century.

Figure 4-4. Basilica of San Lorenzo, interior high altar chapel view looking west, from mobile scaffolding.

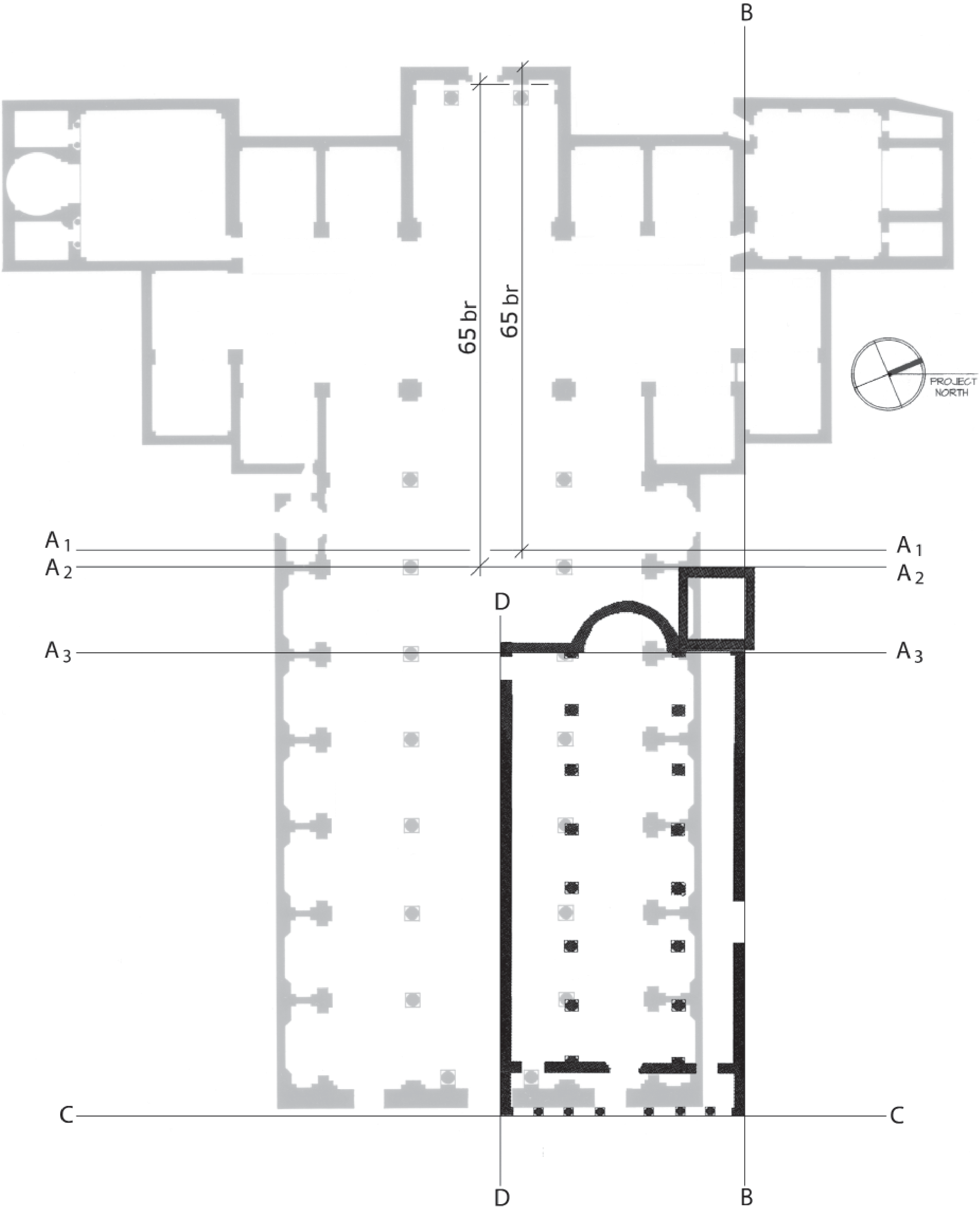


Figure 4-5. Basilica of San Lorenzo with hypothetical old basilica floor plan and analytical locator lines.

Figure 4-6. Basilica of San Lorenzo, left vertical façade seam (above arrow).

Figure 4-7. Basilica of San Lorenzo, right vertical façade seam (above arrow).

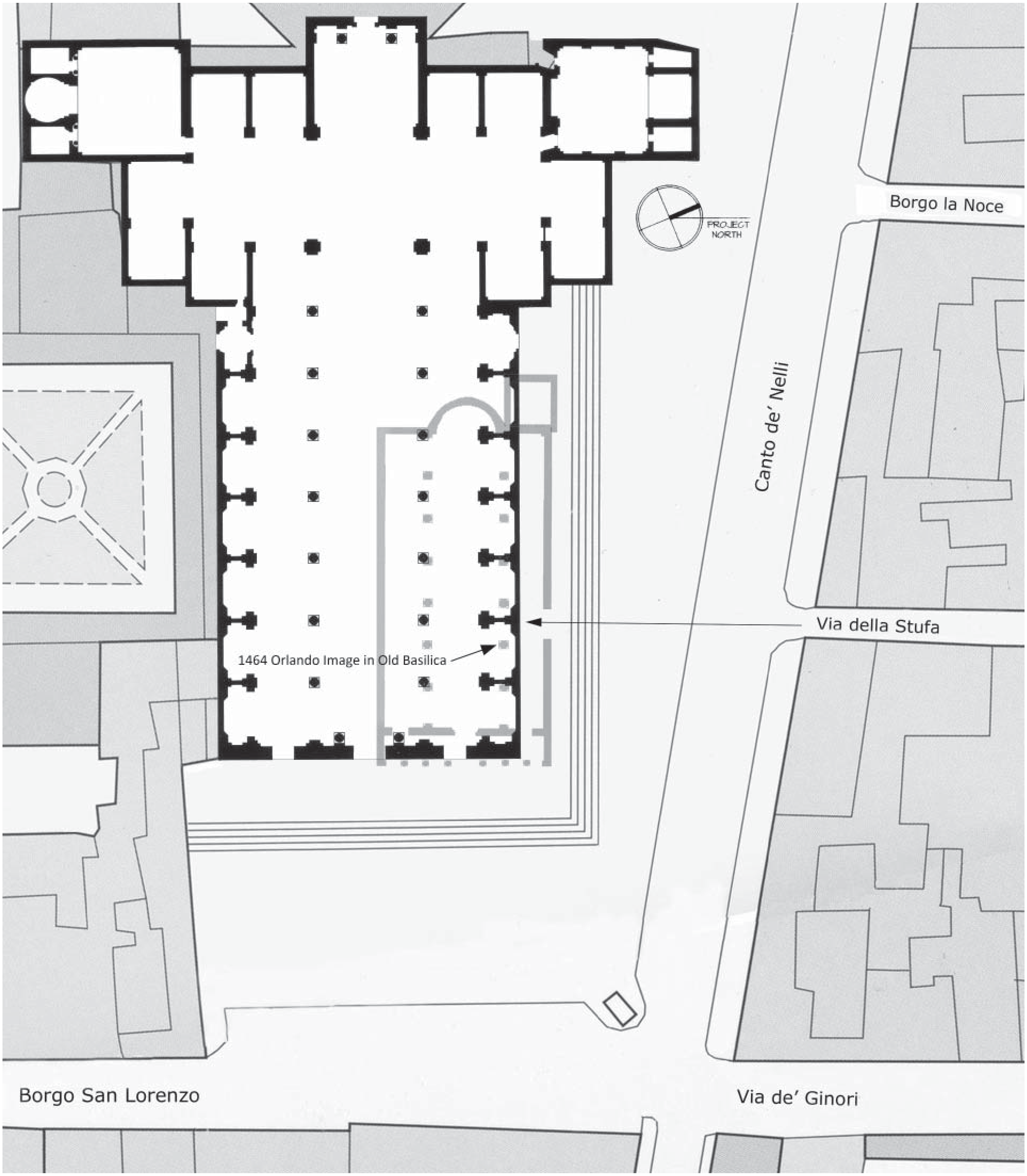


Figure 4-8. Basilica of San Lorenzo with hypothetical old basilica floor plan and indications of architectural references in the testament of Orlando di Giovanni d'Orlandini, 9 October 1464.

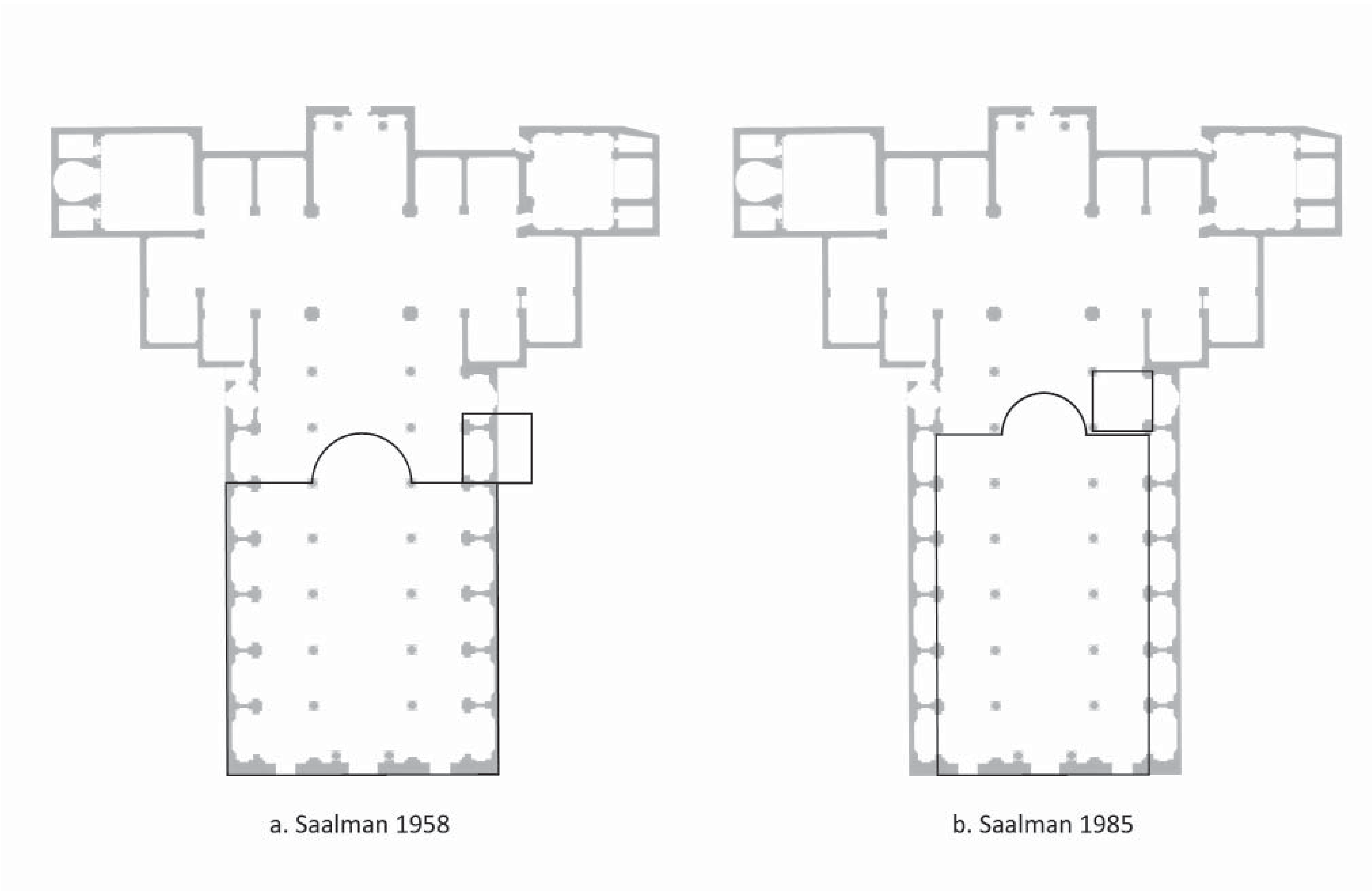


Figure 4-9. Basilica of San Lorenzo floor plans with reconstructions of the old basilica: a) Saalman, Art Bulletin, 1958; and b) Saalman, Art Bulletin, 1985.

Figure 4-10. Basilica of San Lorenzo, masonry fragment in underchurch (Saalman).

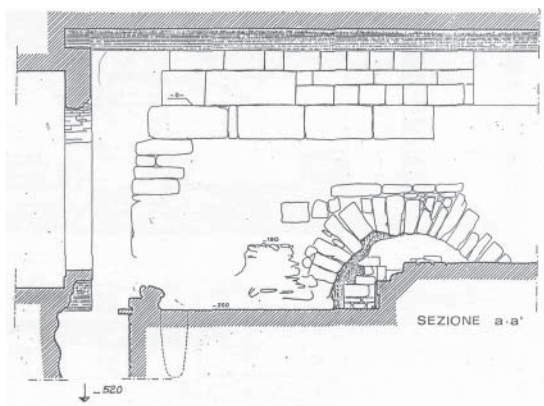


Figure 4-11. Basilica of San Lorenzo, masonry fragment in underchurch (De Marinis, 1993, p. 33).

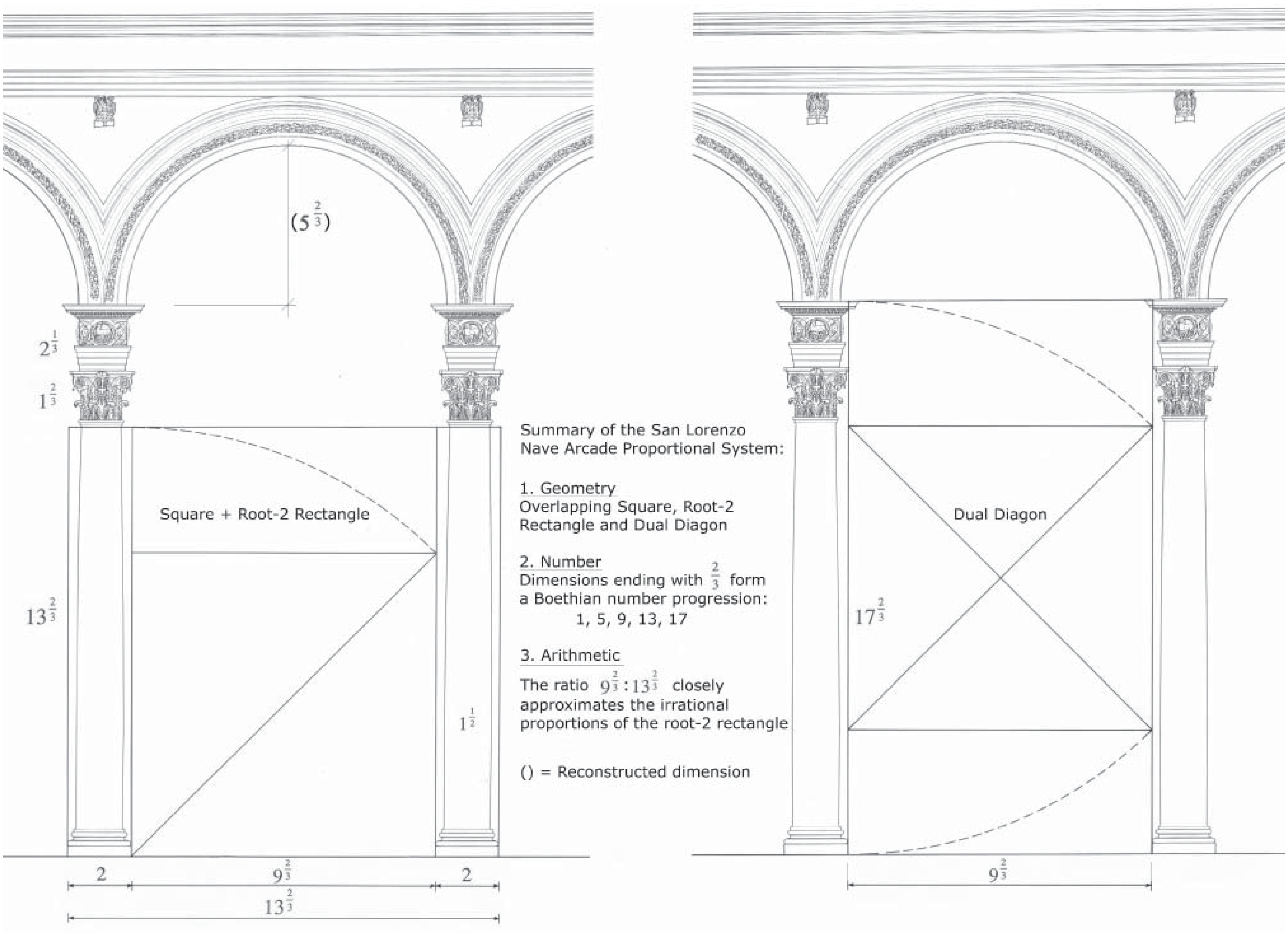


Figure 4-12. Summary of San Lorenzo nave arcade bay proportional system.

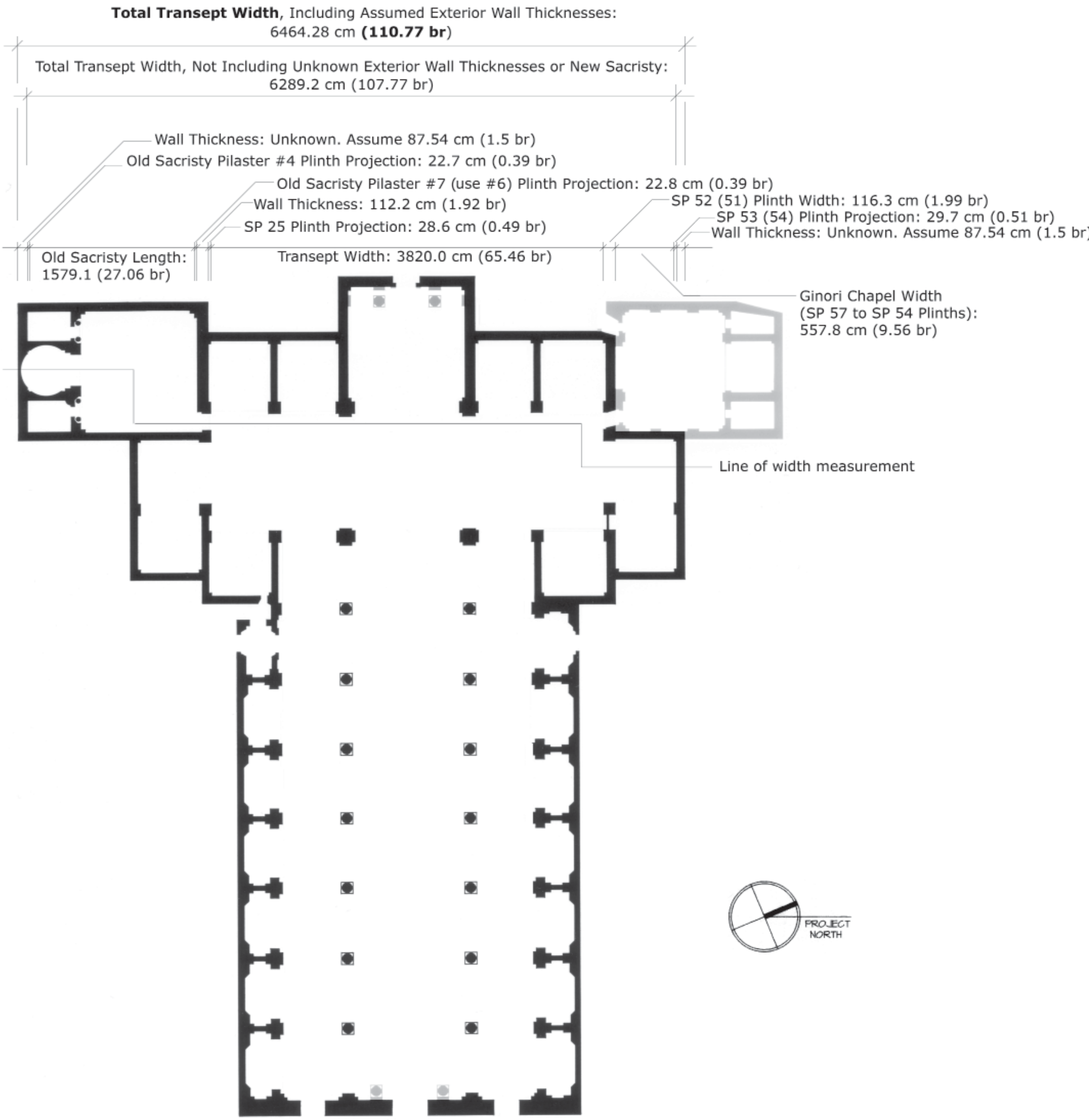


Figure 4-13. Basilica of San Lorenzo, transept width measurements compared to 1418 petition specification of 110 br.

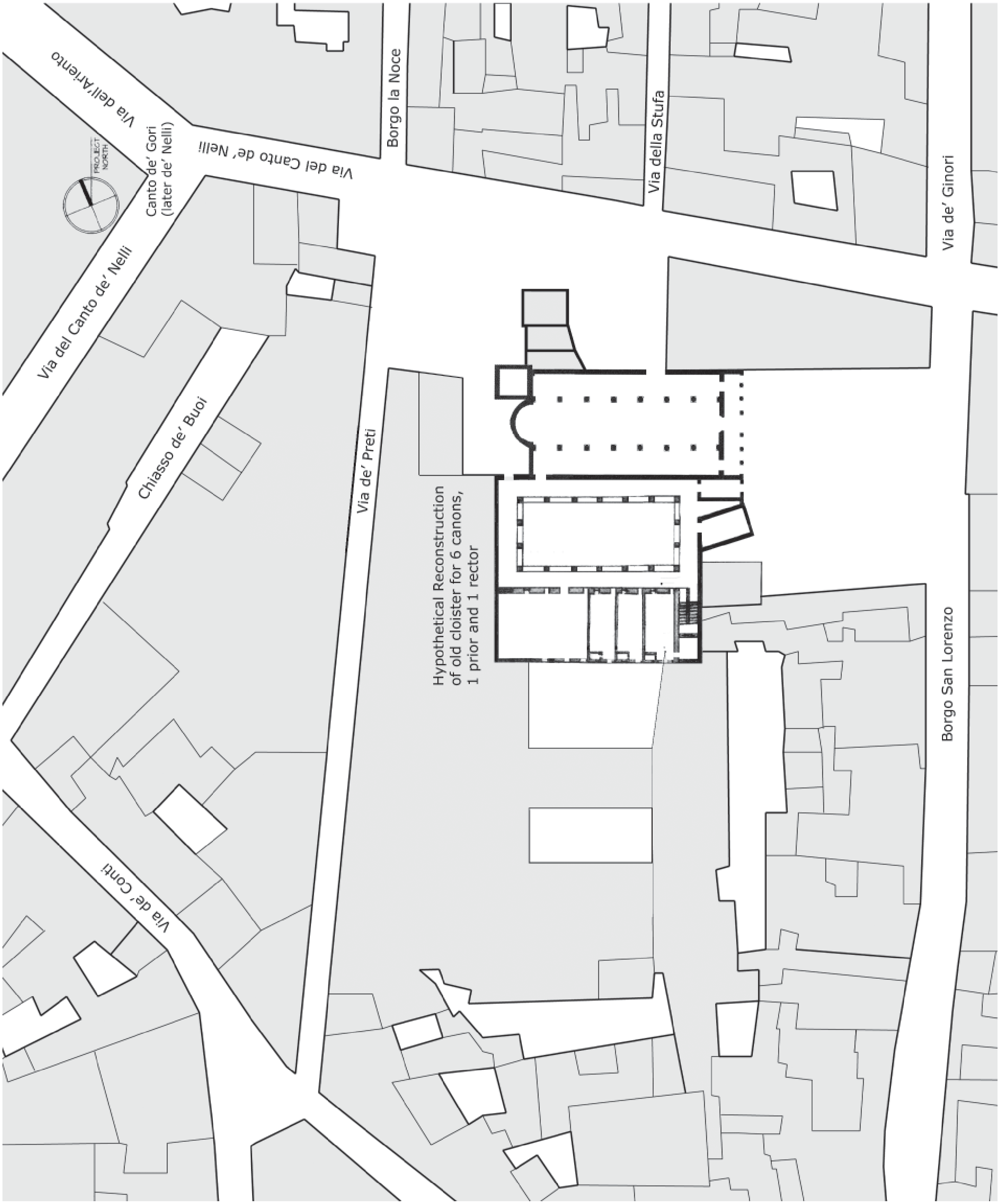


Figure 4-14. Basilica of San Lorenzo, pre-1418 site conditions, reconstruction.

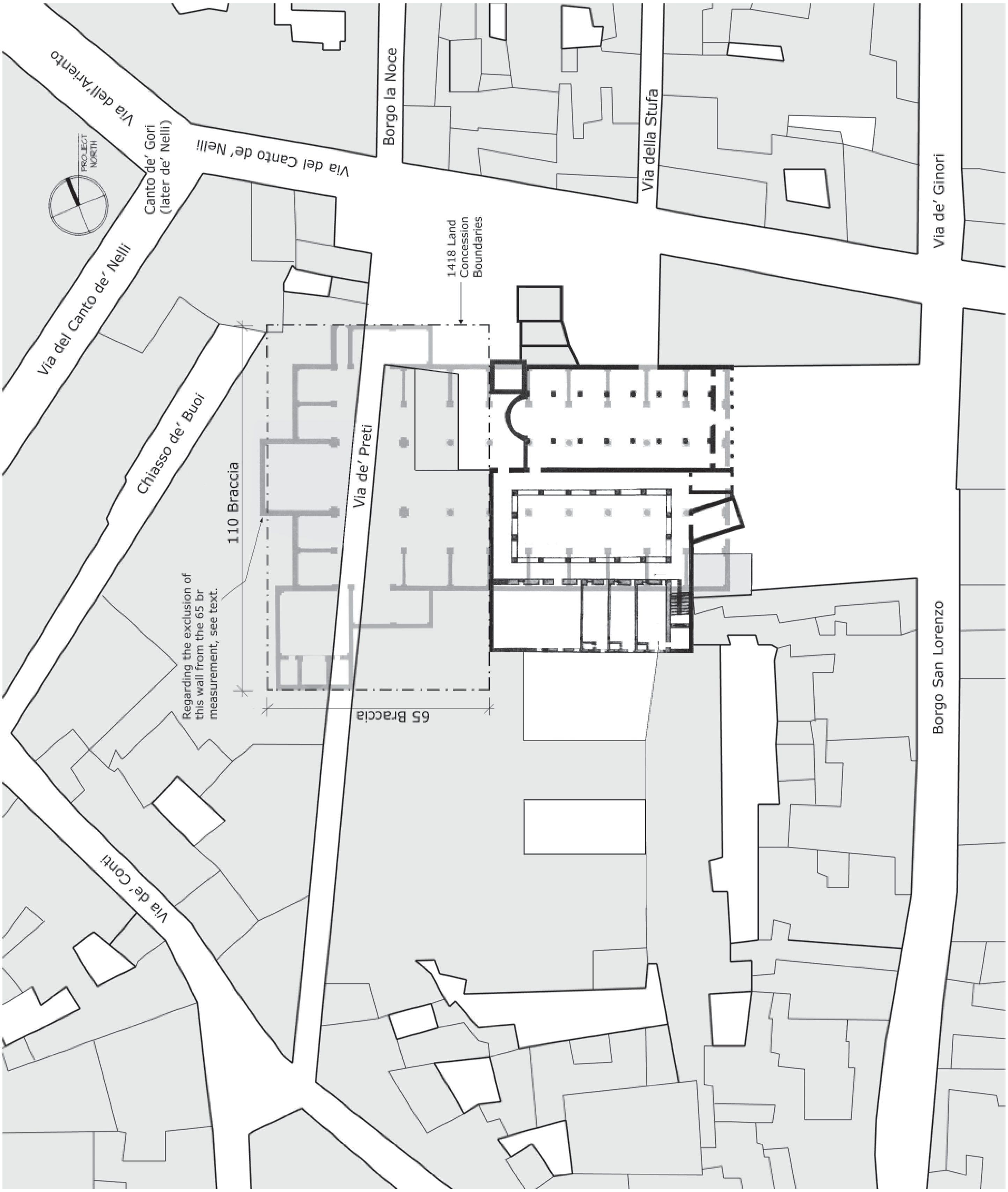


Figure 4-15. Basilica of San Lorenzo, 1418 site conditions, reconstruction.

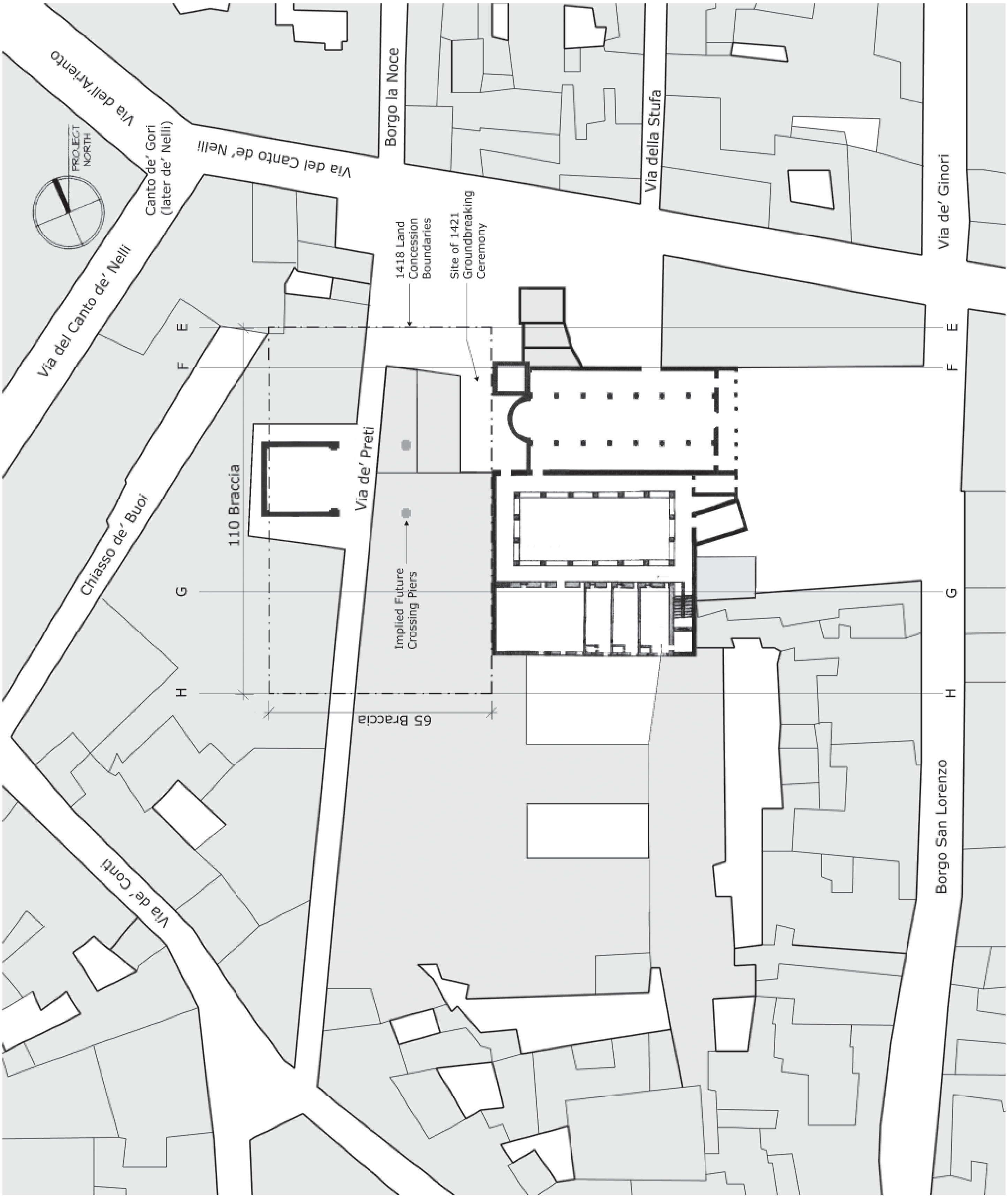


Figure 4-16. Basilica of San Lorenzo, site conditions during Dolfini's tenure, December 1418—April 1422, reconstruction.

Figure 4-17. Cod. Vat. Lat. 5699 (detail), Pietro del Massaio, 28 November 1469.

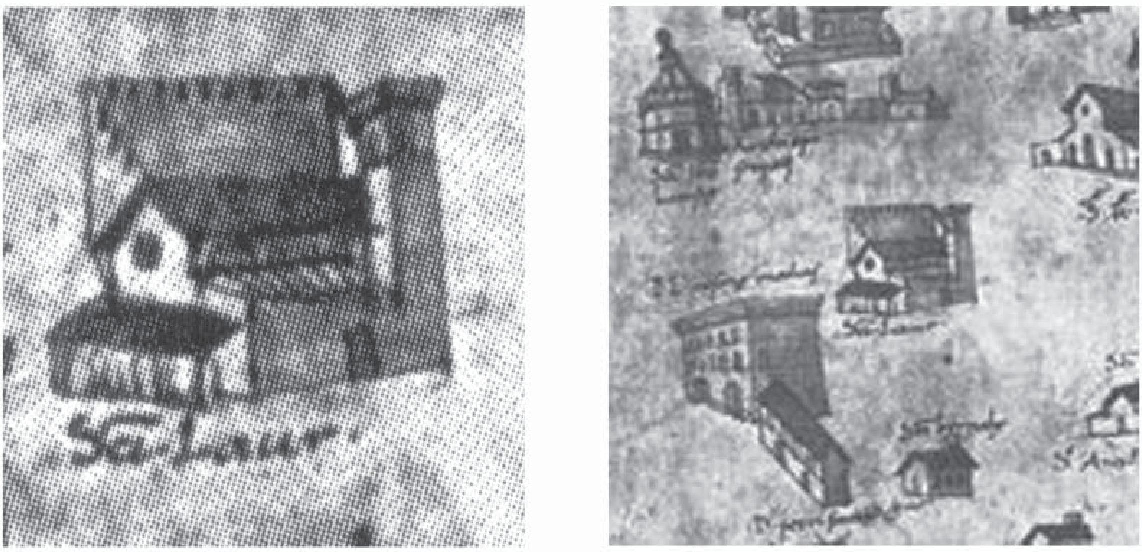


Figure 4-18. Cod. Vat. Urb. 277 (detail), Pietro del Massaio, 1472.

Figure 4-19. MS Lat. 4802 (detail), Pietro del Massaio, c. 1470-72.

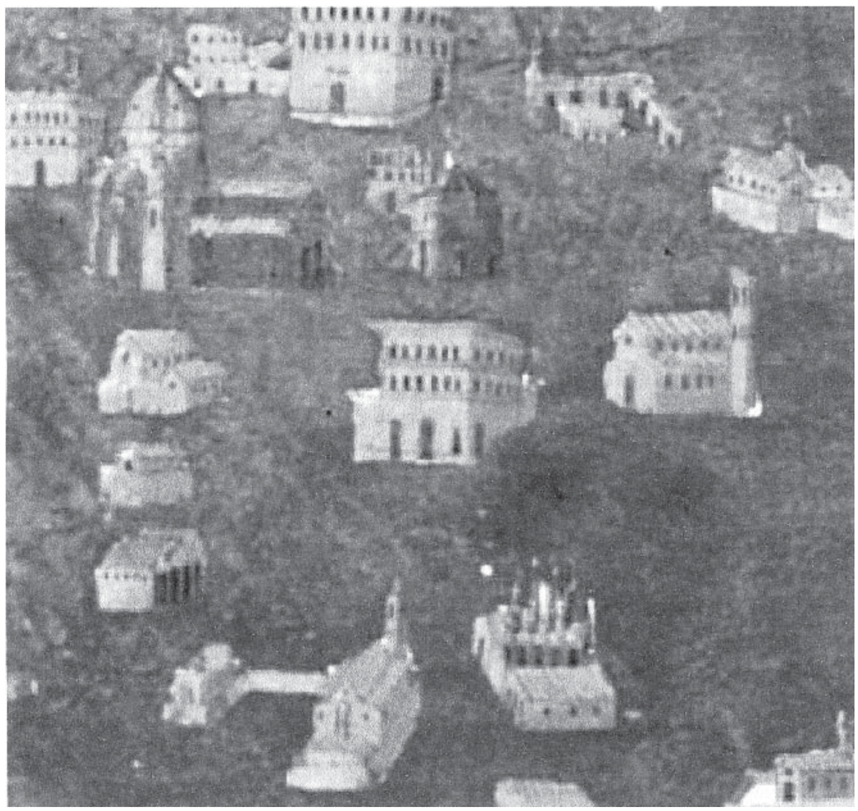


Figure 4-20. Cod. Vat. Lat. 491 (detail), annonymous, c. 1480.

Figure 4-21. Church of San Martino in Quona, thirteenth century, with alterations in sixteenth and eighteenth centuries.

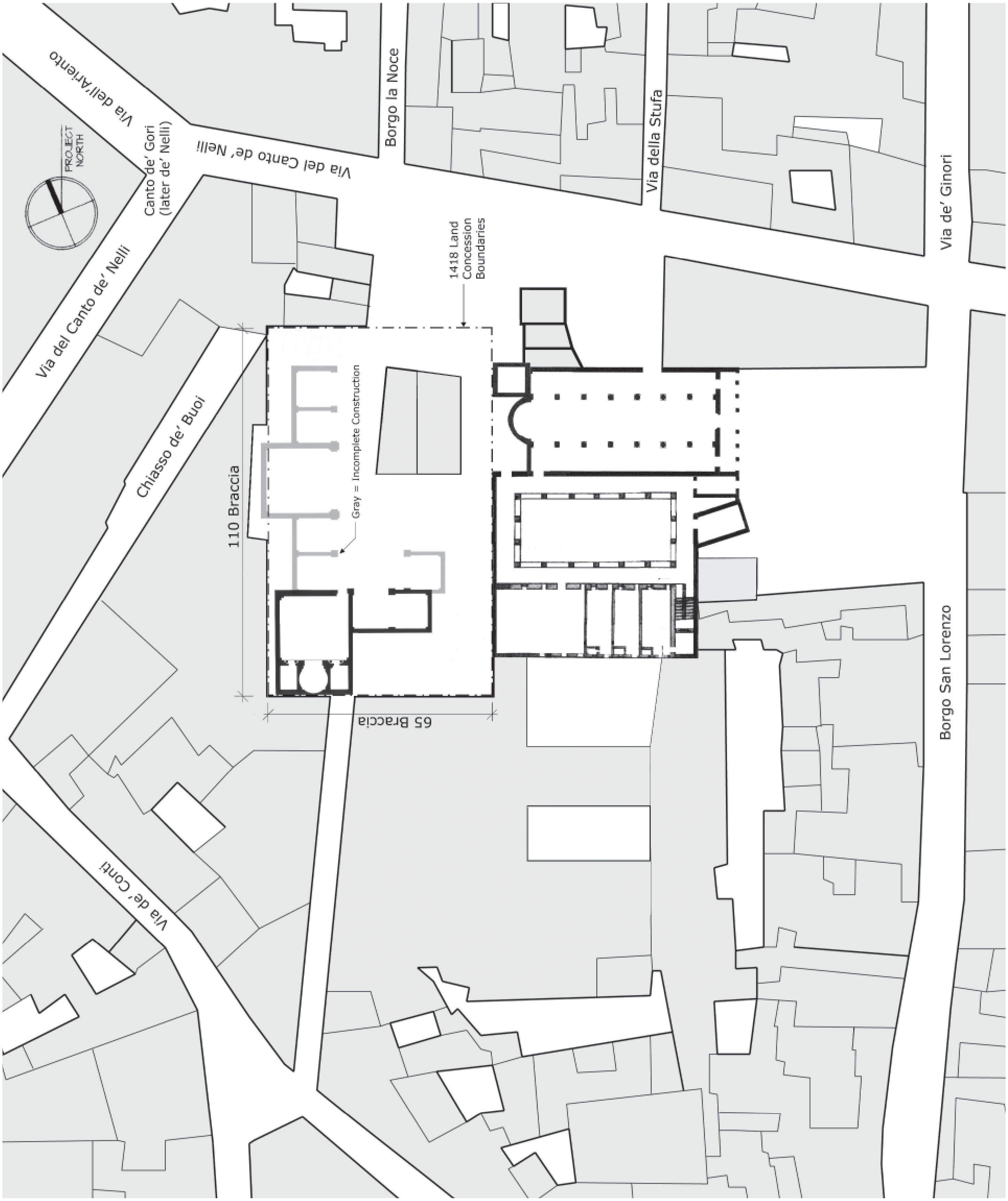


Figure 4-22. Basilica of San Lorenzo, site conditions from 22 April 1422—1429, reconstruction.

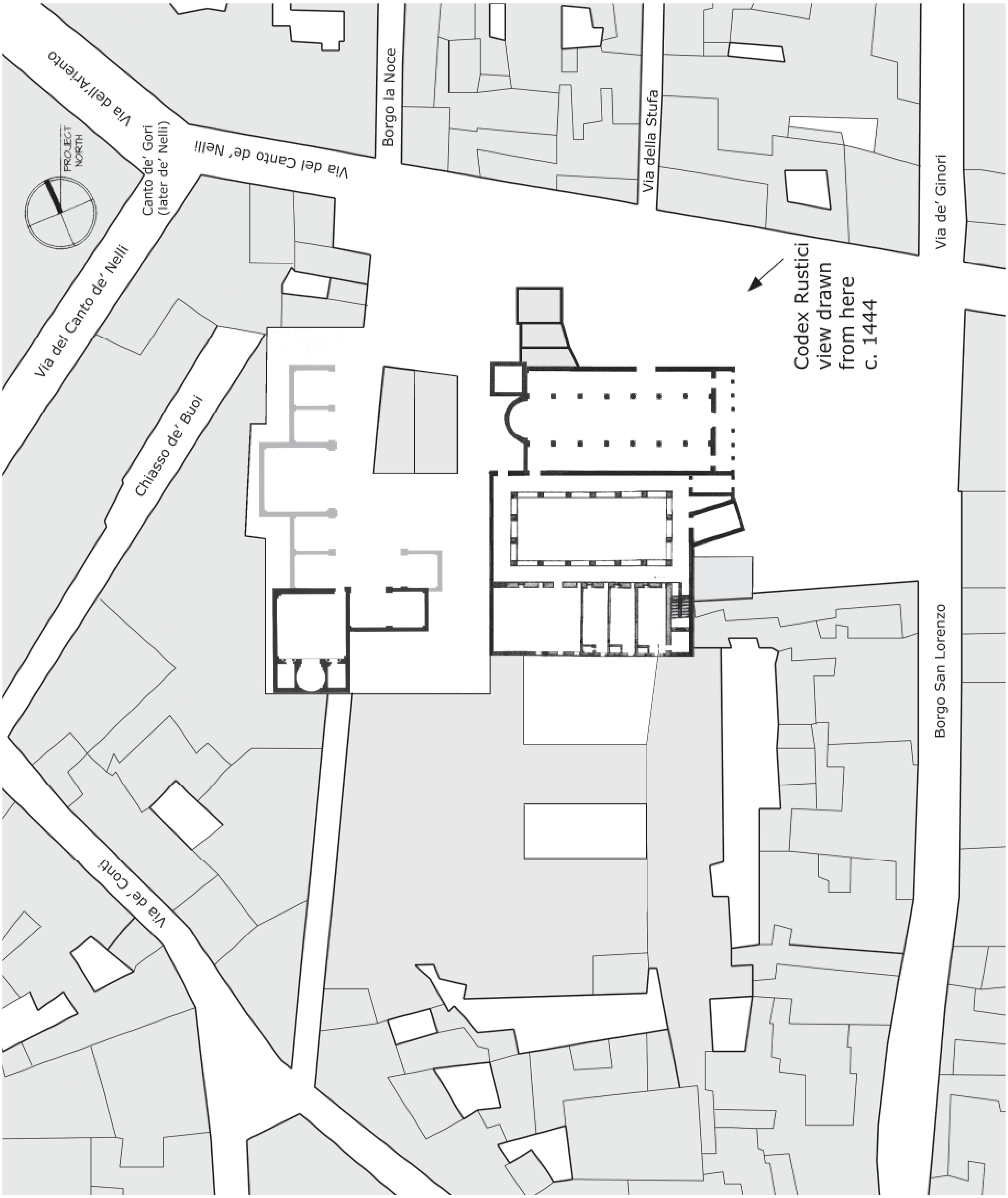


Figure 4-23. Basilica of San Lorenzo, 1434 site conditions, reconstruction.

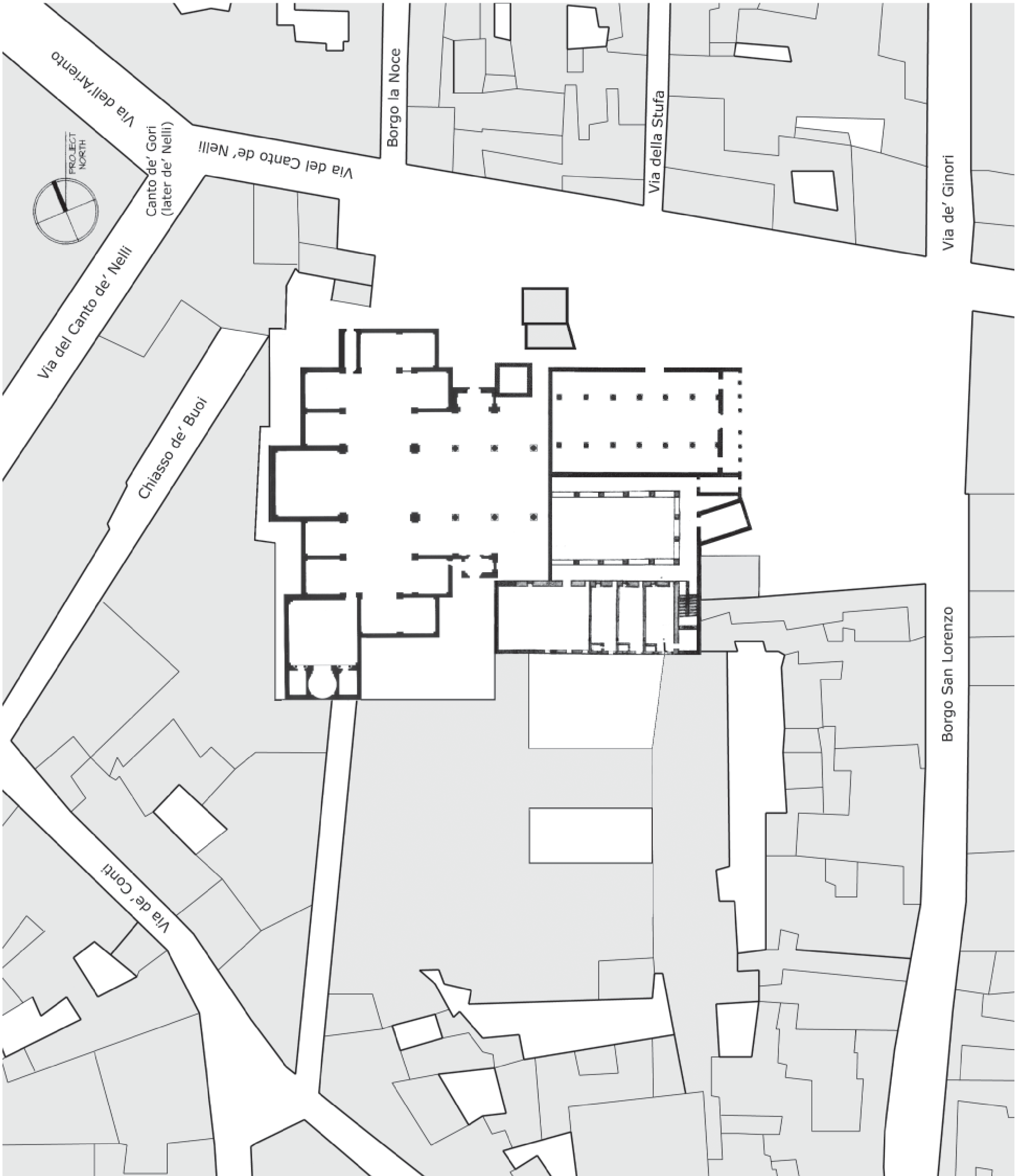


Figure 4-24. Basilica of San Lorenzo, site conditions from March 1442—May 1457, reconstruction.

Figure 4-25. Basilica of San Lorenzo, transept view looking north, from mobile scaffolding.

Figure 4-26. Basilica of San Lorenzo, Old Sacristy, view looking south.

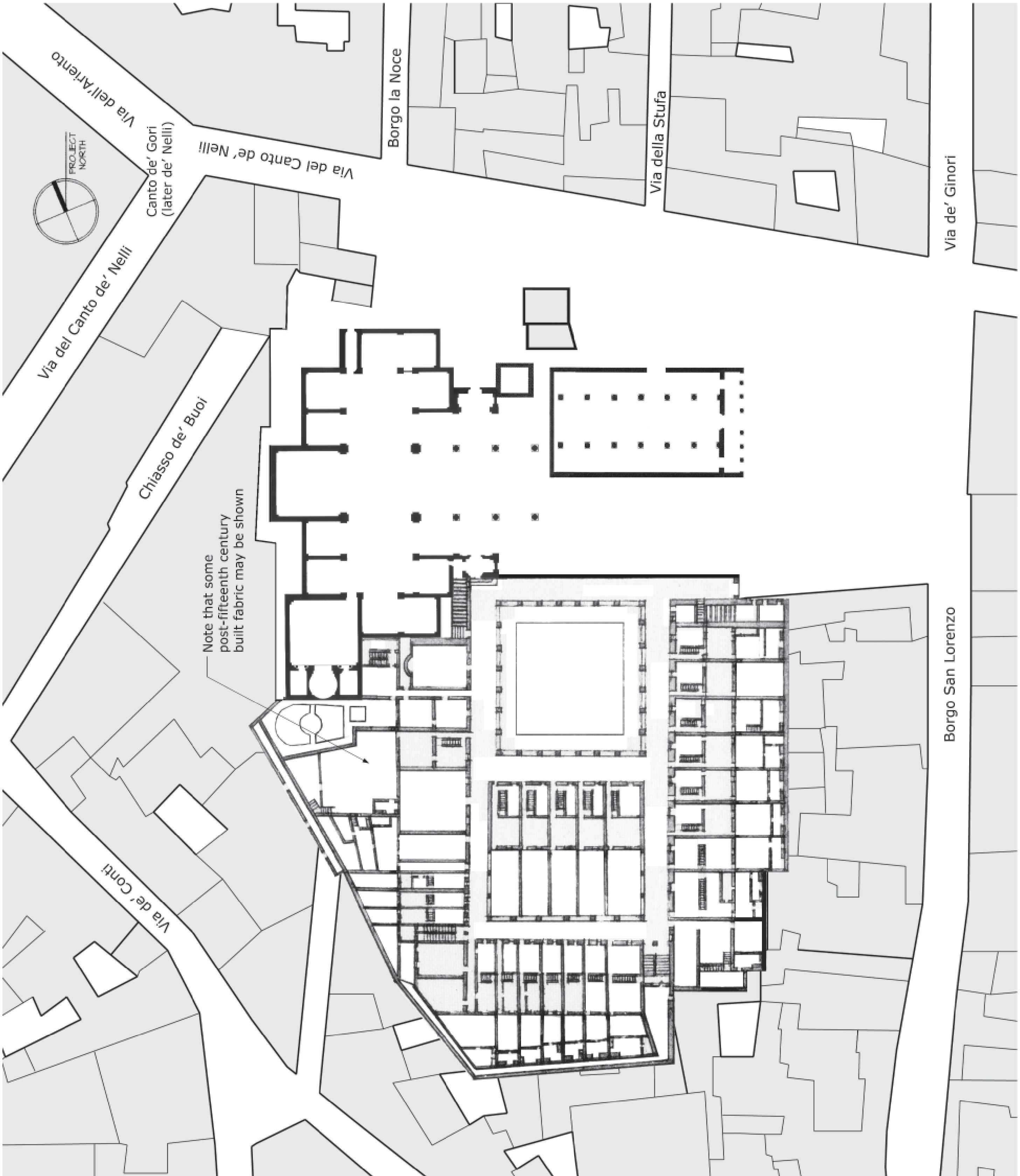


Figure 4-27. Basilica of San Lorenzo, site conditions from May 1457—August 1461, reconstruction.

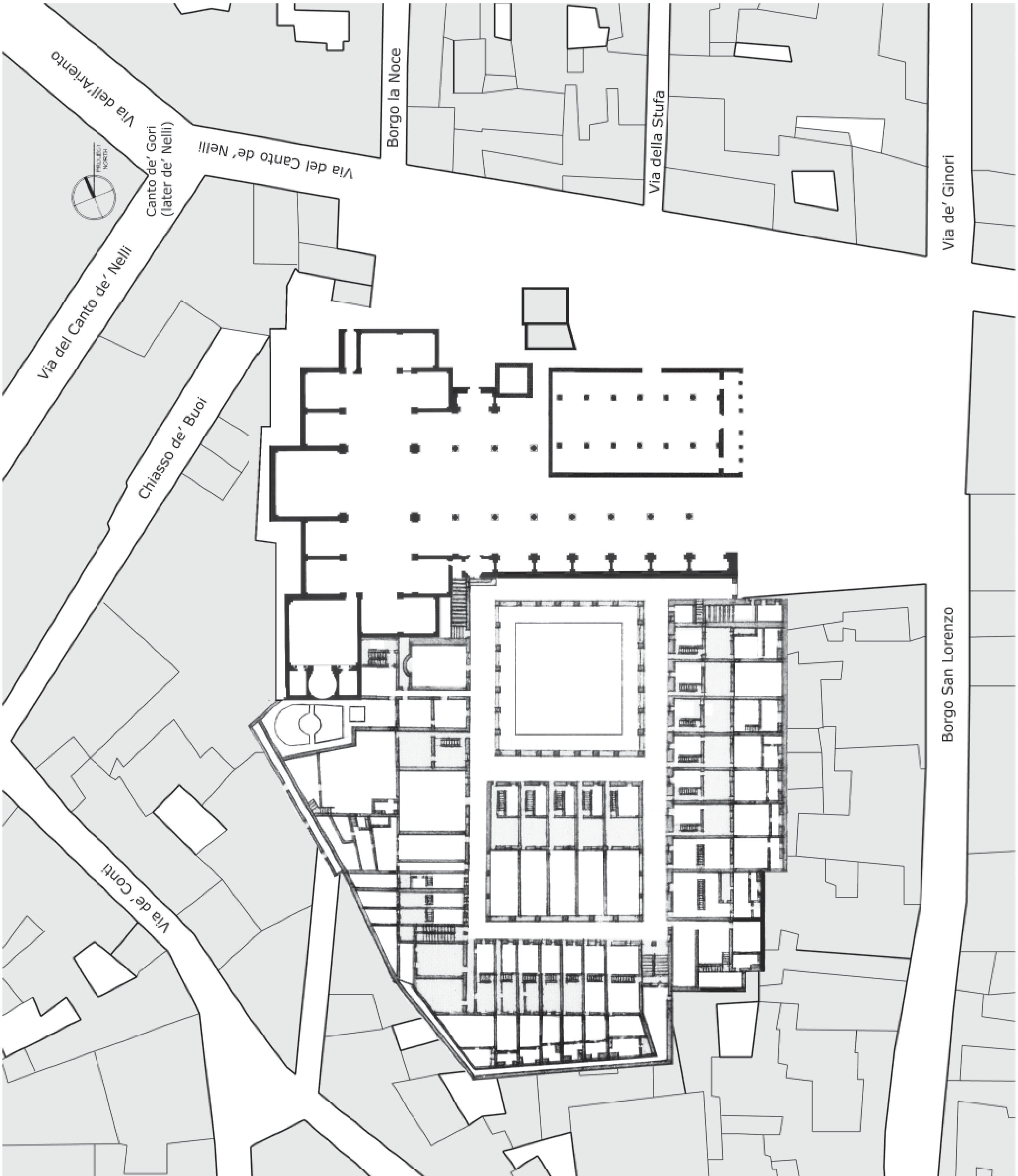


Figure 4-28. Basilica of San Lorenzo, site conditions from August 1461—April 1465, reconstruction.

Figure 4-29. San Lorenzo Nave Arcades Phase II, Floor Pilaster 2, side c, frieze block.

Figure 4-30. San Lorenzo Nave Arcades Phase II, Floor Pilaster 9, side c, frieze block.

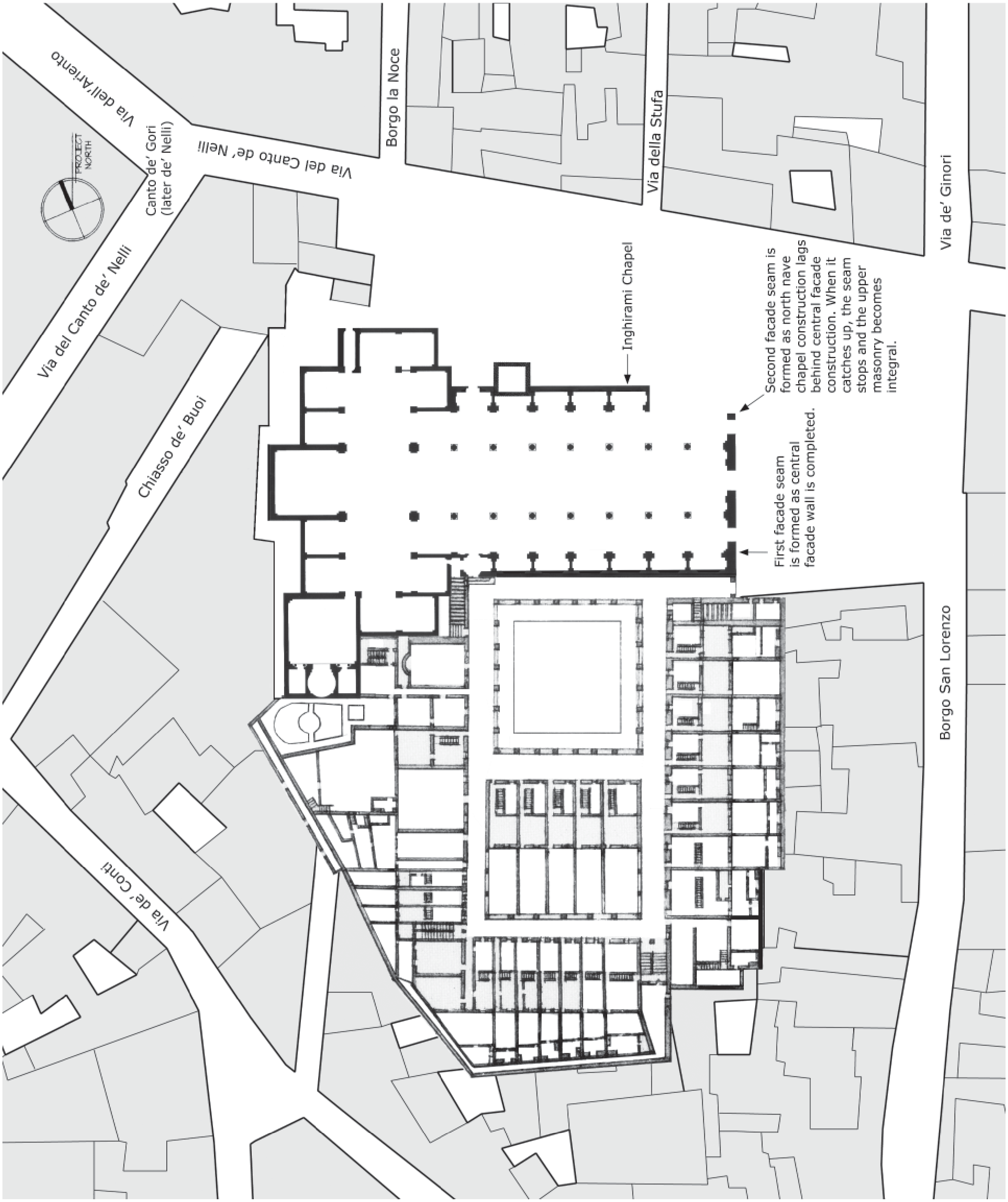


Figure 4-31. Basilica of San Lorenzo, site conditions from April 1465—c. 1475, reconstruction.

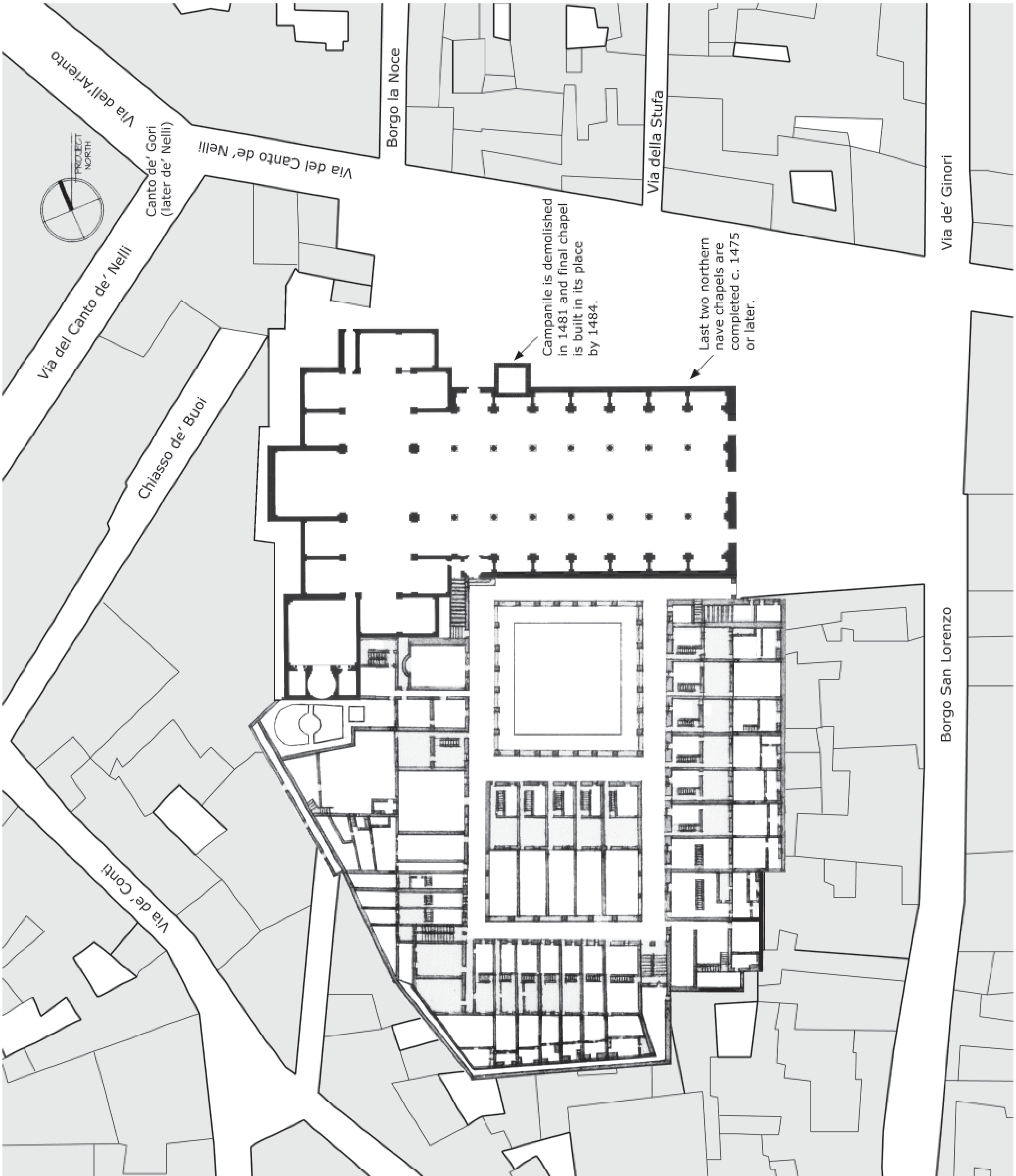


Figure 4-32. Basilica of San Lorenzo, site conditions from c. 1475—June 1481, reconstruction.

Figure 5-1. Map of Italy showing likely source locations for Brunelleschi's stylistic synthesis (author).

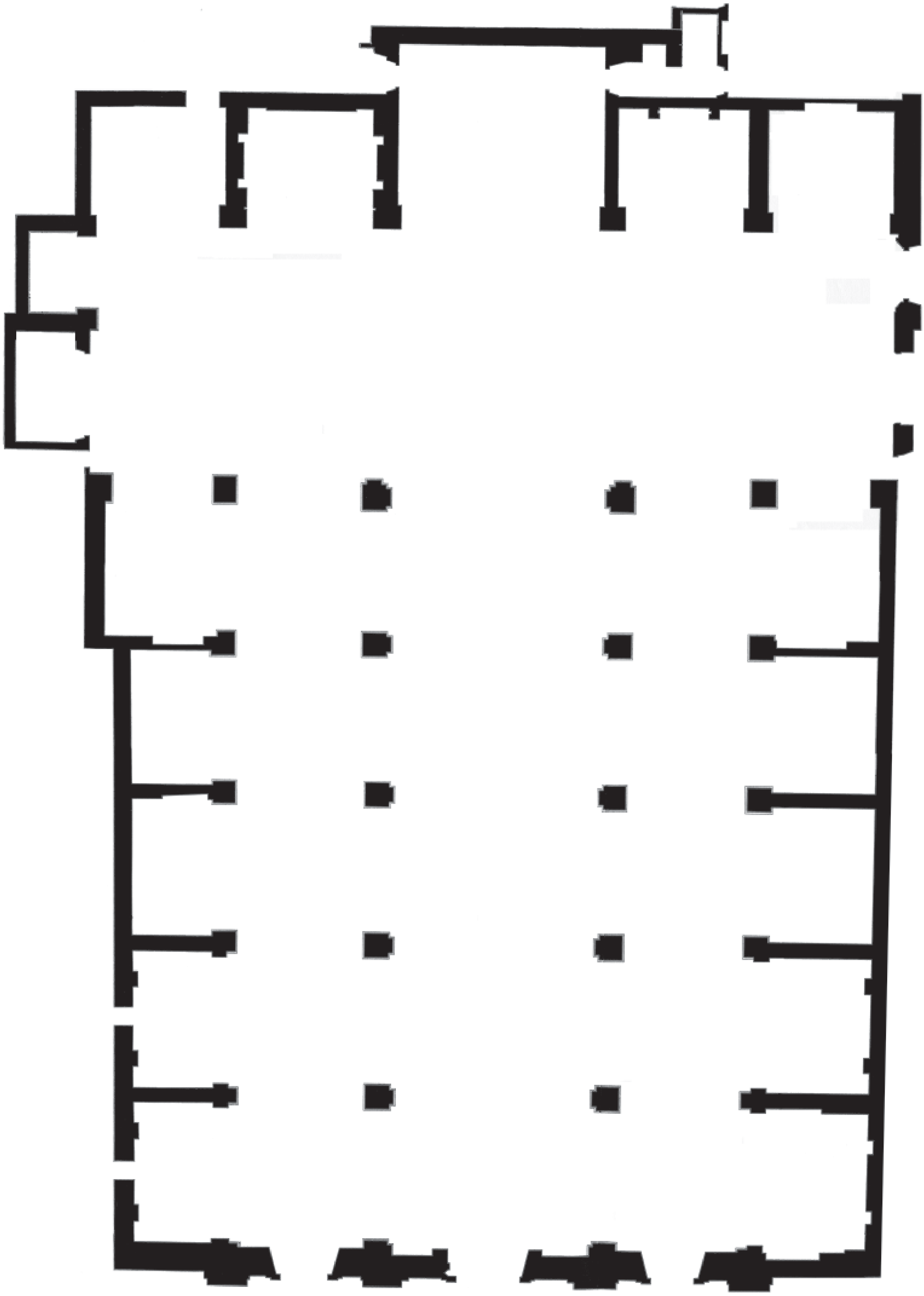


Figure 5-2. Basilica of Santa Trinita, Florence, floor plan (author).

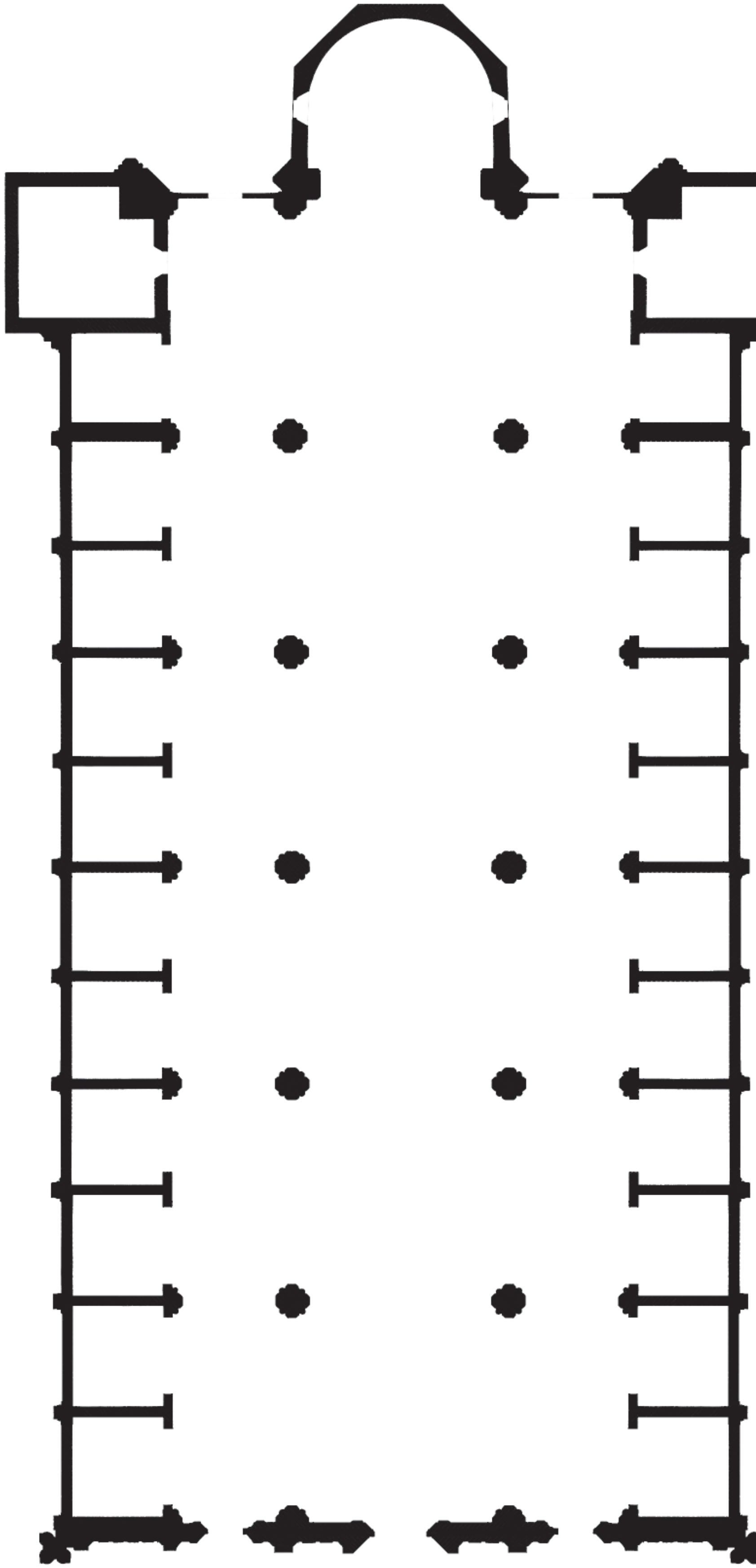


Figure 5-3. Basilica of San Petronio, Bologna, floor plan (author).

Figure 5-4. Basilica of Santa Maria del Carmine, Pavia, nave view (author).

Figure 5-5. Basilica of San Petronio, Bologna, nave bay (author).

Figure 5-6. Basilica of Santa Maria del Carmine, Pavia, nave bay (author).

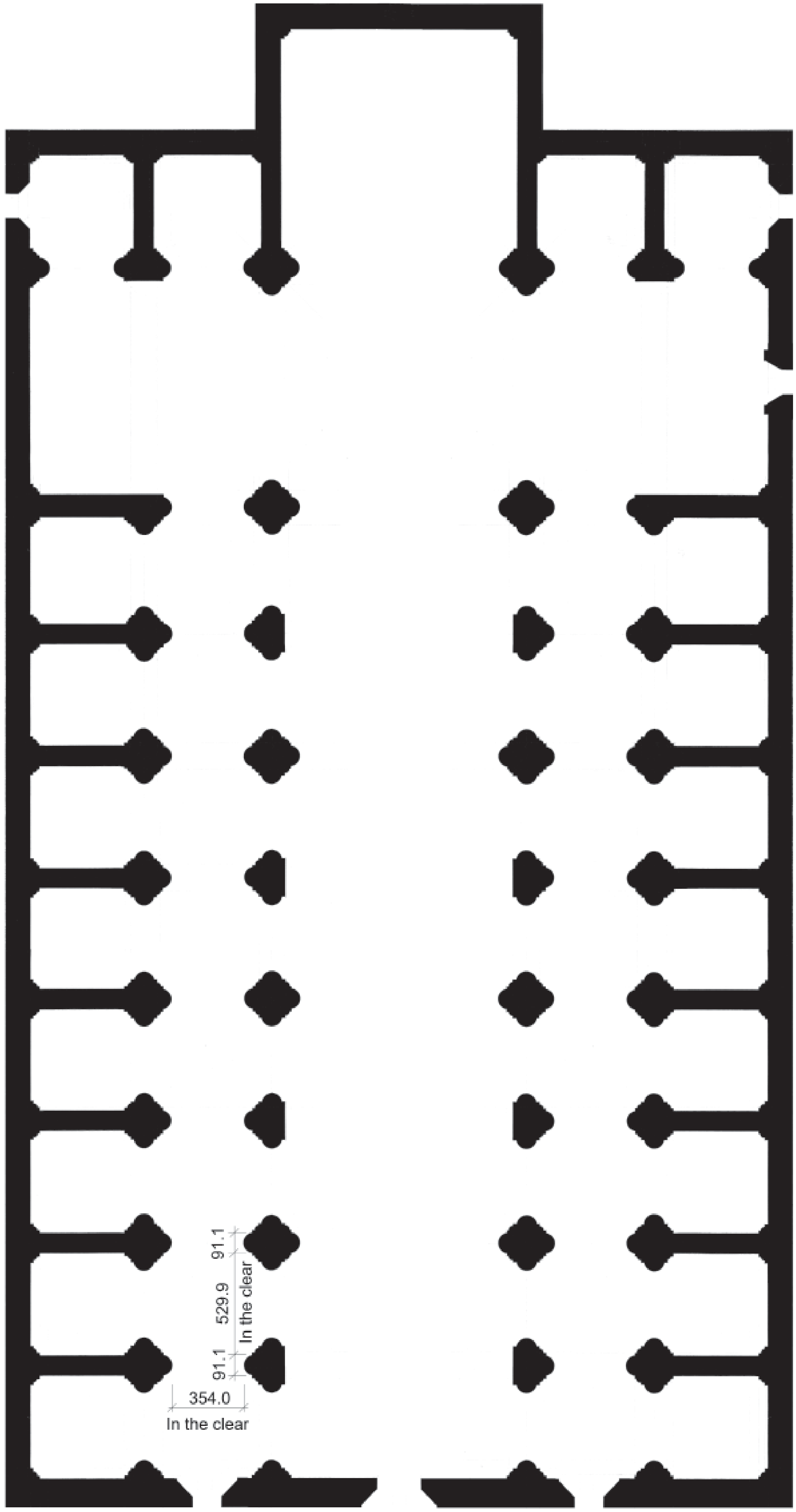


Figure 5-7. Basilica of Santa Maria del Carmine, Pavia, floor plan (author).

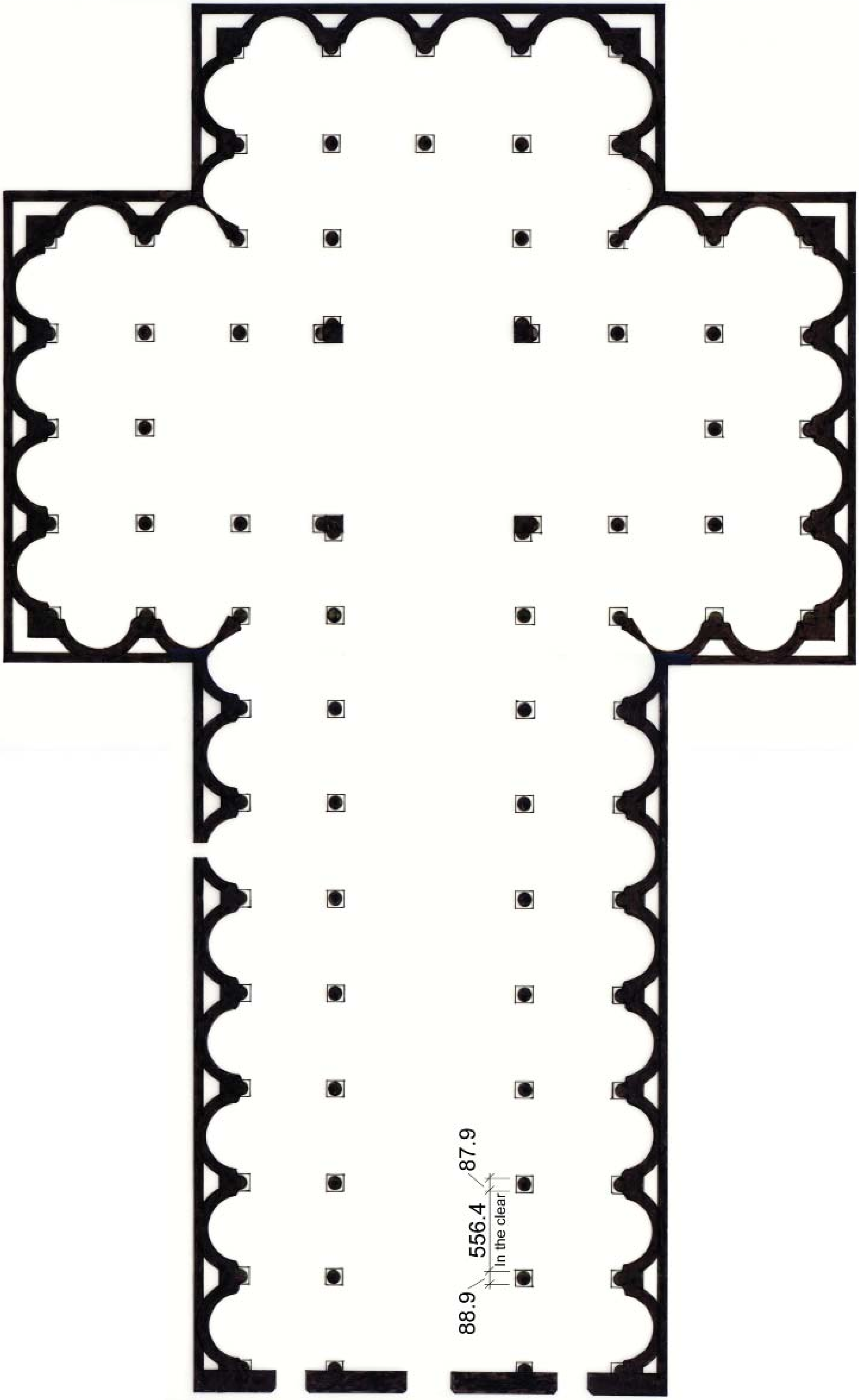


Figure 5-8. Basilica of Santo Spirito, Florence, floor plan (author).

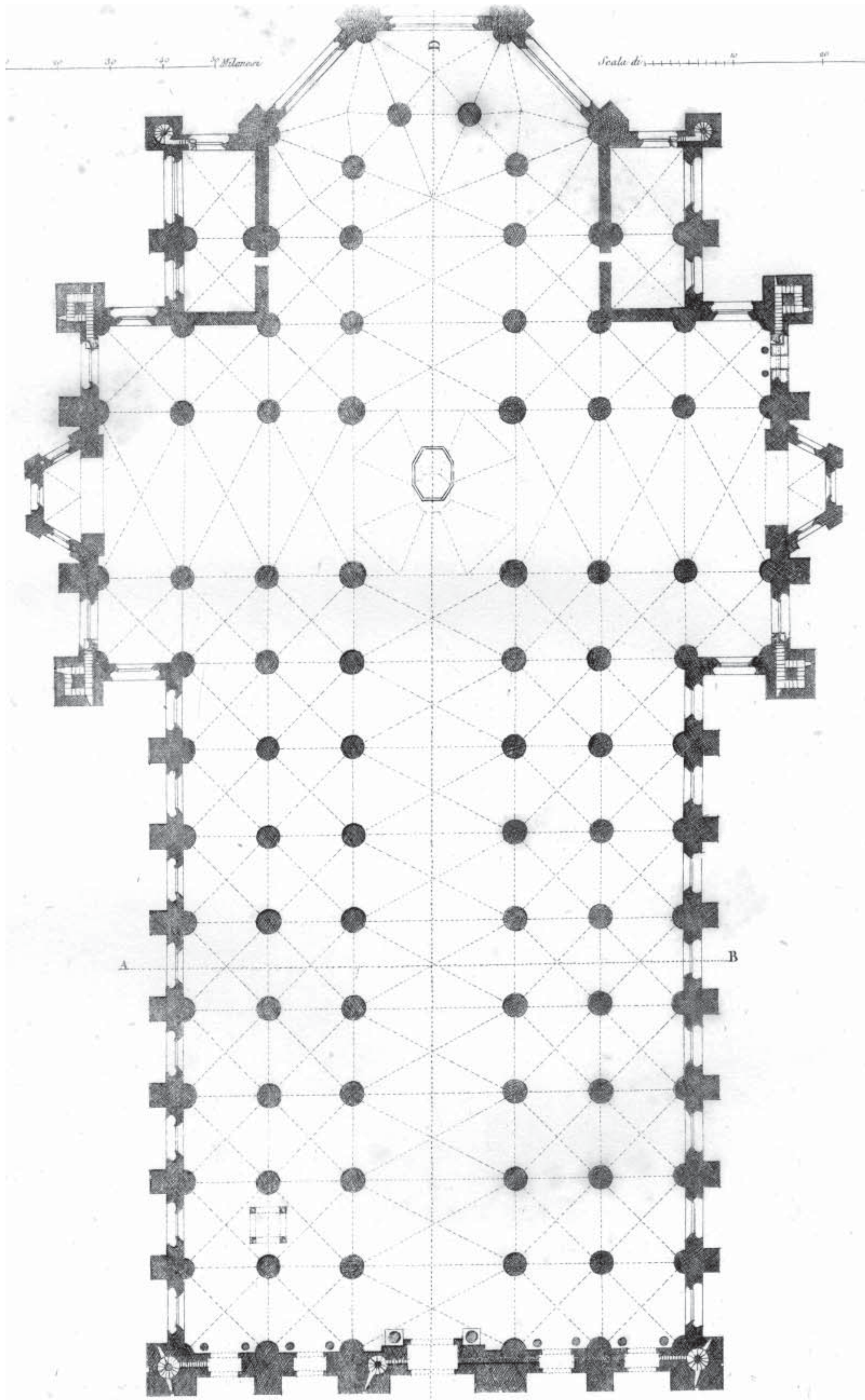


Figure 5-9. Cathedral of Milan, floor plan (Franchetti).

Figure 5-10. Basilica of Santo Spirito, Florence, aisle view (author).

Figure 5-11. Basilica of Santa Maria del Carmine, Pavia, aisle view (author).

Figure 5-12. Masaccio, Trinity (detail), Basilica of Santa Maria Novella, Florence (Soprintendenza ai Monumenti, Florence).

Figure 5-13. Basilica of Santo Spirito, Florence, engaged column plinth and chapel step detail (author).

Figure 5-14. Basilica of Santa Maria del Carmine, Pavia, engaged column plinth and chapel step detail (author).

Figure 5-15. Abbey Church of Cerreto, Lodi, nave view (Romanini).

Figure 5-16. Rome, The Pantheon, Portico column base detail (author).

Figure 5-17. Francesco Talenti, Nave Arcade Bay (ca. 1357-ca. 1366), Basilica of Santa Maria del Fiore, Florence. View looking southeast. Author is shown measuring from atop Pier 9 in June 2008 (for numeration see next figure). Photograph by Stefano Guiducci.

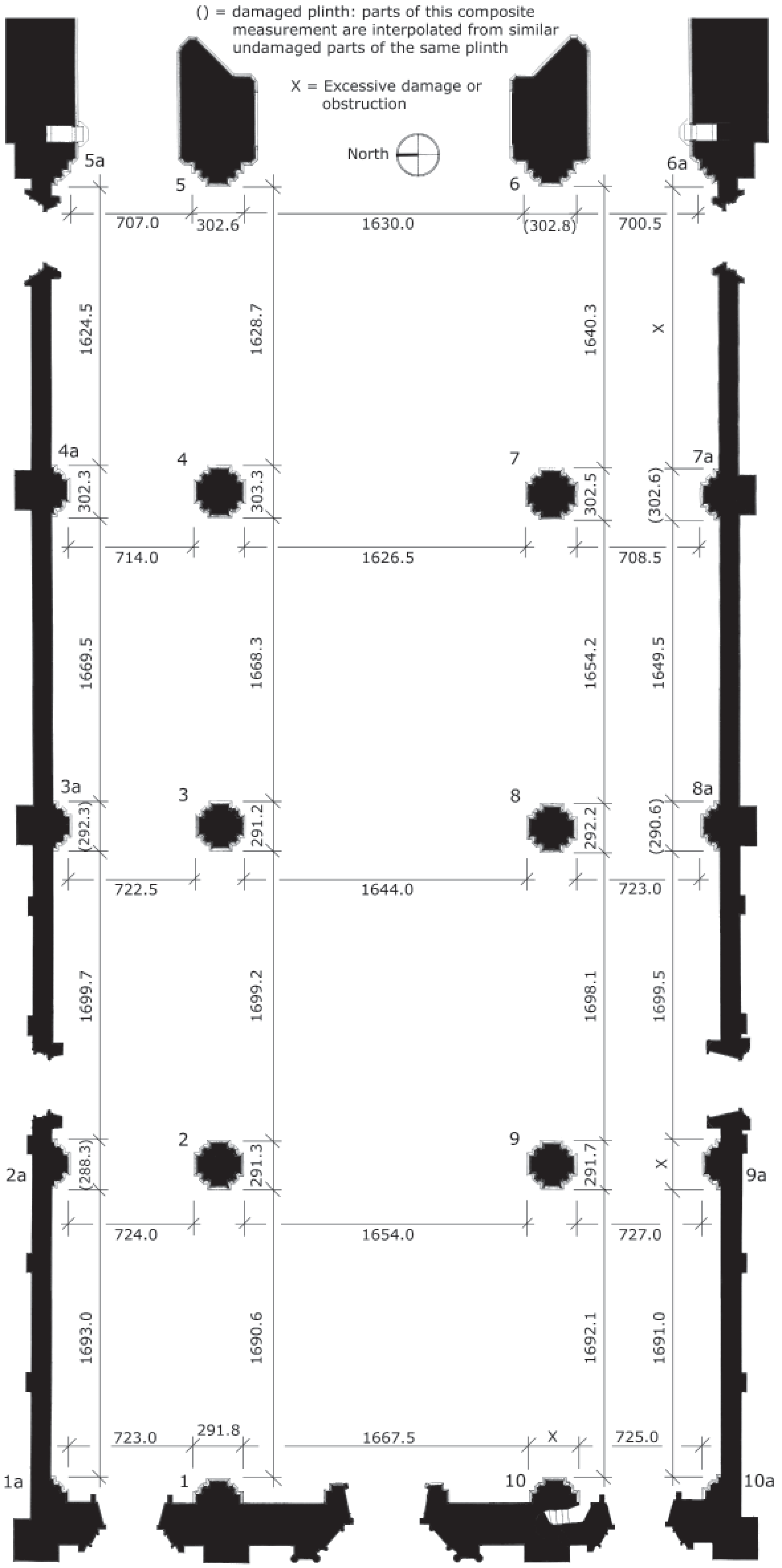


Figure 5-18. Basilica of Santa Maria del Fiore, Florence. Nave floor plan (redrawn after Rocchi et al.) annotated with measurements in cm by Matthew Cohen.

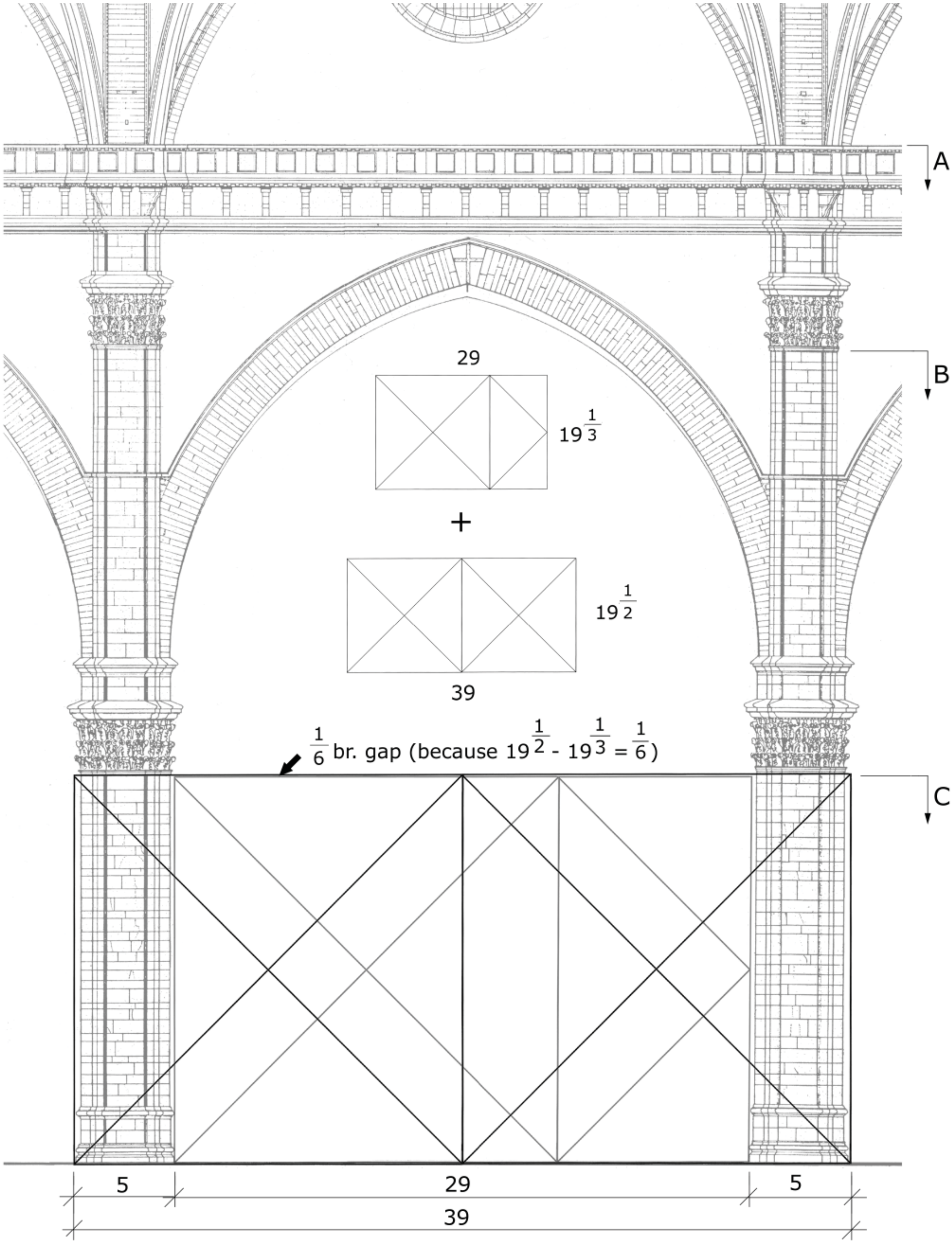


Figure 5-19. Francesco Talenti, , Nave Arcade Bay (designed ca. 1357), Basilica of Santa Maria del Fiore, Florence. Square-and-a-half and two-square proportions and dimensions. Base drawing by Rocchi et al., with proportional overlays and other modifications by Matthew Cohen.

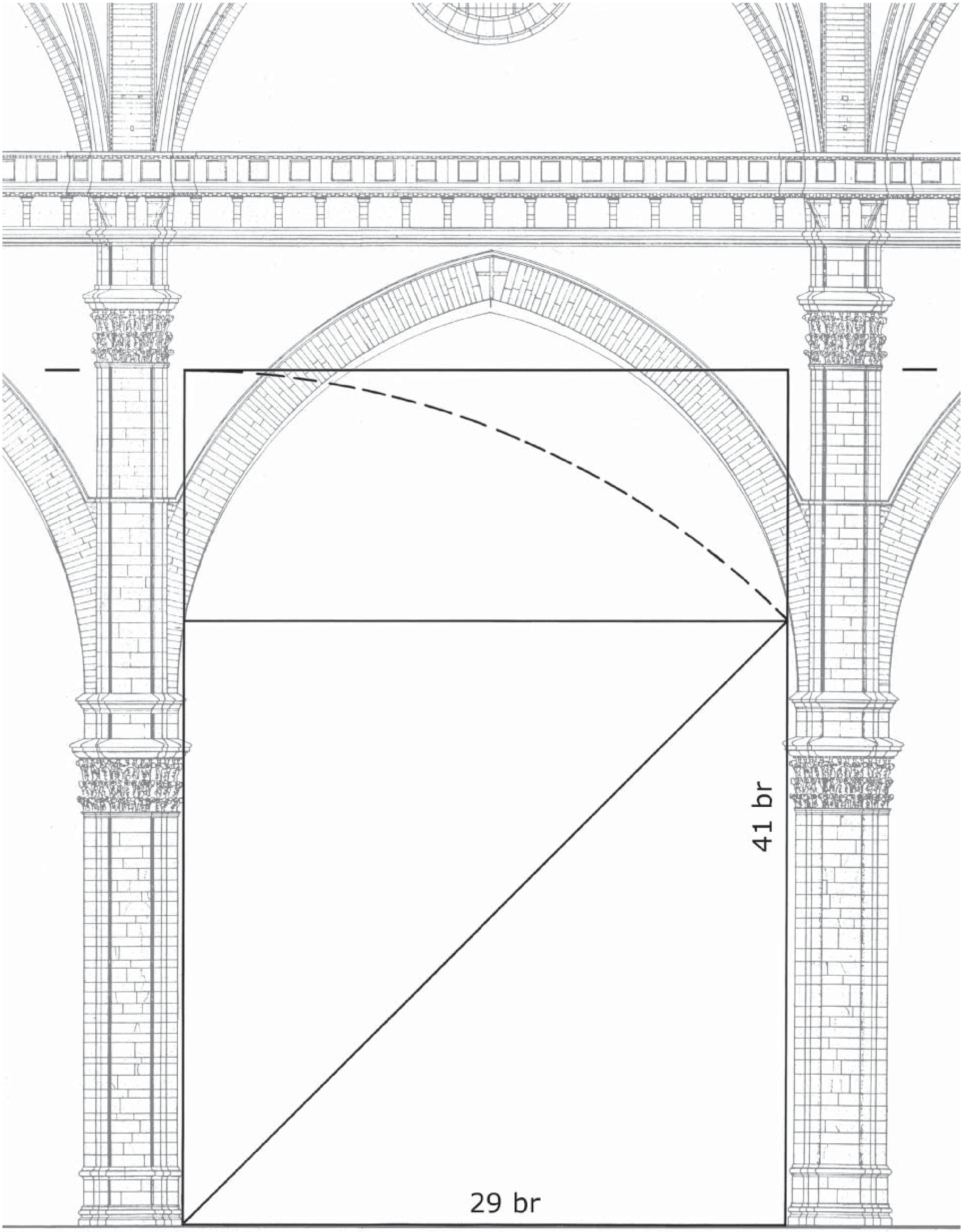


Figure 5-20. Francesco Talenti, Nave Arcade Bay (designed ca. 1357), Basilica of Santa Maria del Fiore, Florence. Root-2 rectangle proportion and dimensions. Base drawing by Rocchi et al., with proportional overlays and other modifications by Matthew Cohen.

SANTA MARIA DEL FIORE NAVE PIER AND UPPER GALLERY VERTICAL DIMENSIONS										
Measurements in cm and *braccia*, as indicated (1 br = 58.36 cm)										
NAVE ARCADE, NORTH										
Nave Pier Number:	**1**		**2**		**3**		**4**		**5**	
	cm	**br**	**cm**	**br**	**cm**	**br**	**cm**	**br**	**cm**	**br**
A. Top of Upper Gallery (*Ballatoio*) Railing to Floor	3012.5	51.62	2996.4	51.34	2992.7	51.28	2991.9	51.27	2990.0	51.23
B. Upper Pier Shaft (excluding astragal) to Floor	2399.7	41.12	2400.0	41.12	2408.1	41.26	2390.3	40.96	2388.4	40.93
C. Lower Pier Shaft (excluding astragal) to Floor	1136.3	19.47	1132.5	19.41	1135.3	19.45	1133.5	19.42	1134.5	19.44
NAVE ARCADE, SOUTH										
Nave Pier Number:	**10**		**9**		**8**		**7**		**6**	
	cm	**br**	**cm**	**br**	**cm**	**br**	**cm**	**br**	**cm**	**br**
A. Top of Upper Gallery (*Ballatoio*) Railing to Floor	3006.8	51.52	3007.1	51.53	2980.9	51.08	2976.3	51.00	2977.4	51.02
B. Upper Pier Shaft (excluding astragal) to Floor	2397.8	41.09	2389.1	40.94	2395.2	41.04	2388.5	40.93	2395.5	41.05
C. Lower Pier Shaft (excluding astragal) to Floor	1135.5	19.46	1134.0	19.43	1130.0	19.36	1132.5	19.41	1132.8	19.41

Figure 5-21. Santa Maria del Fiore Nave Pier and Upper Gallery Vertical Dimensions (author). For dimension key see two figures previous.

Value	Name of Fraction	Gerbert	Turchillus
$\frac{12}{12}$	as	×	I, X
$\frac{11}{12}$	deunx	[illegible]	[illegible]
$\frac{10}{12}$	decunx, dextans	[illegible]	[illegible]
$\frac{9}{12}$	dodrans	[illegible]	[illegible]
$\frac{8}{12}$	bisse, bes, bissis	[illegible]	[illegible]
$\frac{7}{12}$	septunx	[illegible]	[illegible]
$\frac{6}{12}$	semis	[illegible]	S
$\frac{5}{12}$	quincunx	[illegible]	[illegible]
$\frac{4}{12}$	trien, triens	[illegible]	[illegible]
$\frac{3}{12}$	quadrans	[illegible]	[illegible]
$\frac{2}{12}$	sextans	[illegible]	[illegible]
$\frac{1}{12}$	uncia	[illegible]	[illegible], ÷
$\frac{1}{8}$	sescuntia	[illegible]	[illegible]
$\frac{1}{24}$	semuncia	[illegible]	V
$\frac{11}{24}$	semuncideunx		[illegible]
$\frac{1}{36}$	duella	UU	UU
$\frac{1}{48}$	sicilius	[illegible]	[illegible]
$\frac{1}{72}$	sextula	C	U
$\frac{1}{96}$	dragma	∗	∗
$\frac{1}{144}$	dimidia sextula, hemisecla, emisescla	Ψ	Ψ
$\frac{1}{216}$	tremissis	H	H
$\frac{1}{288}$	scripulus	[illegible]	[illegible]
$\frac{1}{576}$	obulus	—	[illegible], [illegible]
$\frac{1}{1152}$	cerates		[illegible]
$\frac{1}{1728}$	siliqua		[illegible], [illegible]
$\frac{1}{864}$	bissiliqua		[illegible]
$\frac{1}{2304}$	calcus		[illegible], [illegible], [illegible]

Figure 6-1. Examples of Roman fraction symbols found in the trattati d'abbaco of Gerbert (10th century) and Turchillus (12th century).

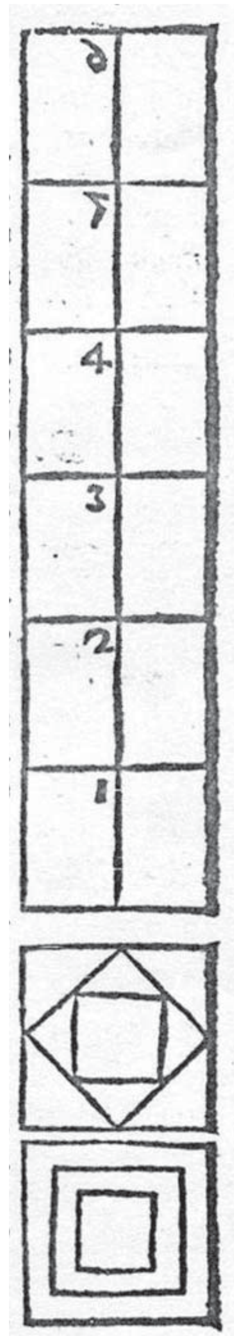


Figure 6-2. Rotation of Squares Technique, Anonymous contribution to Gregor Reisch, Margarita filosofica (Venice, 1599).

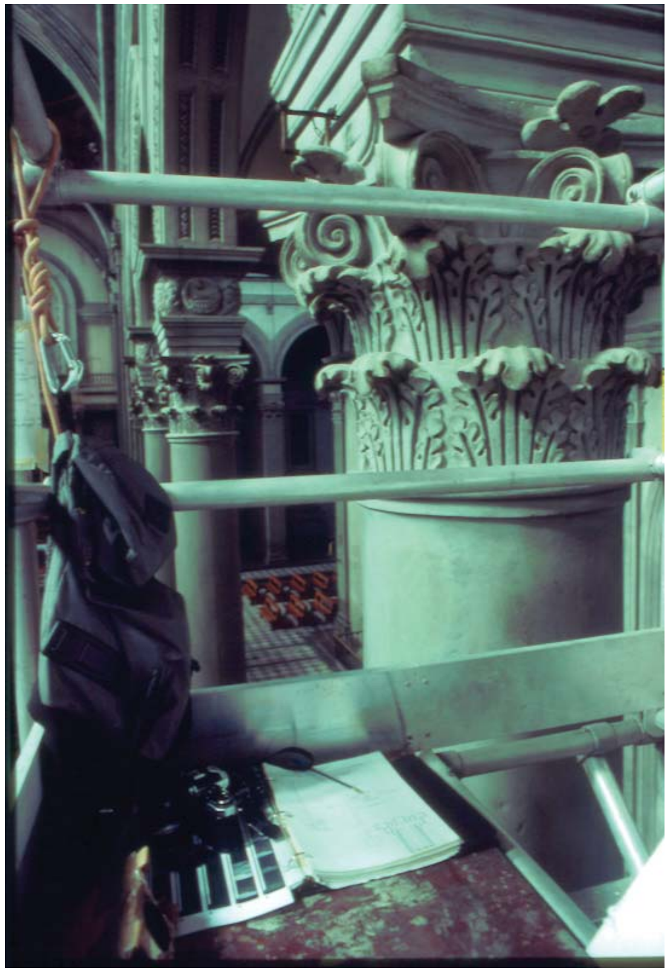


Figure 6-3. Author’s scaffolding in the Basilica of San Lorenzo, 1992.

Figure 6-4. Author's scaffolding in the Basilica of Santo Spirito, 1992.

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Summary

In preparation for the historical investigations of the basilicas of San Lorenzo and Santo Spirito presented in the main body of this study, the introduction (Chapter 1) examines longstanding scholarly preconceptions pertaining to the basilica of San Lorenzo, and their likely causes. It demonstrates that the persistent scholarly association of the orderly appearance of this basilica with the subject of architectural proportion stretches back over two centuries, and appears to be rooted in the inherent ambiguity contained within both the word and concept of proportion. Since the eighteenth century, the introduction argues, most architectural historians have associated proportion *simultaneously* with mathematical (or geometrical) relationships *and* architectural beauty. This conflation has led architectural historians to treat architectural proportion as an aesthetic problem rather than an historical one; and thus, to treat it as a mode of speculation about the causes of early Renaissance architectural beauty as perceived by historians, rather than as a cultural product of the fifteenth-century that can illuminate the intentions of early Renaissance architects and patrons.

In order to remove aesthetics from any discussion of proportion as an historical problem, this introduction establishes definitions that distinguish between proportion as a description of architectural beauty, and proportion as a mathematical (or geometrical) relationship. It then builds upon the latter definition by proposing that late medieval and early Renaissance architects created "sets of proportions," embedded in the dimensions and quantities of architecture, to communicate non-visual, iconographical content. Thus, the present study reframes the subject of architectural proportion as part of the rhetorical rather than aesthetic structure of architecture.

This reframing represents a radical departure from the customary view of architectural proportion as a primary contributor to Renaissance aesthetics. Indeed, this customary view is so firmly established among scholars today that it may be considered a paradigm—I call it the Wittkower paradigm, in acknowledgment of Rudolf Wittkower's singular role in promoting it in his various publications of the 1940s and 1950s. Since most scholars will likely be inclined to interpret the findings of this study in terms of the Wittkower Paradigm, and since I believe that such an

interpretation would be fundamentally incorrect, in the introduction I provide a brief critical summary of this paradigm, identifying three main characteristics of it: 1) an aesthetic interpretation of architectural proportion, 2) suppression of the object of study, and 3) the theory that I call "Geometry vs. Number." Readers will thus be able to recognize this paradigm as a distinct theoretical framework that need not be accepted as a given.

Chapter 2 turns to the basilica of San Lorenzo and begins with a metrical analysis of a single bay of the nave arcades. This analysis is based on an original survey, conducted by the author from mobile scaffolding erected in the basilica by the Italian authorities for this purpose. This metrical analysis forms the basis of a new methodology that combines observation-based and documentary sources in order to identify the proportions of the arcades accurately, and to distinguish them from coincidental ones. It then applies this new methodology to reveal three overlapping sets of proportions in the San Lorenzo nave arcade bays, each exhibiting the architect's mastery of geometry, number theory and arithmetic, respectively. The scope of this chapter expands when necessary to examine the arcade bays of the basilica of Santo Spirito as a comparison with those of San Lorenzo, as well as broad historical themes pertaining to late medieval geometry, number, arithmetic, and systems of measurement. These subsidiary explorations all serve the purpose of illuminating the intentional sets of proportions in the San Lorenzo nave arcade bays. Although I have measured and analyzed the basilica of Santo Spirito as comprehensively as the basilica of San Lorenzo, and although the former provides crucial evidence in support of the findings of this study, the majority of this study is devoted to the basilica of San Lorenzo because it is by far the more historically complex and important of the two basilicas.

Chapter 3 applies the methods and concepts developed in Chapter 2 to the problem of understanding the proportions (proportion-1 and proportion-3) of the overall basilica, including the Old Sacristy. Based on the author's comprehensive survey of the entire interior of the basilica, this chapter proposes a logical, step-by-step reconstruction of the design of the basilica, beginning with successive subdivisions of a two-square rectangle, and proceeding through numerous elaborations and refinements. This procedure reproduces many of the obscure and seemingly irregular measurements found in the basilica floor plan and interior elevations today, and thus suggests that the logic of proportion can serve not only as a subject of architectural history research, but also as a tool with which to study it—provided that that logic can be demonstrated to be the result of the architect's intentions, rather than coincidence. Chapter 3 concludes by identifying a seemingly anomalous feature of the iconographical program of this basilica—a feature unrelated to Saint Lawrence or any common Medici themes as might be expected—and interprets it as a possible effort by the builders to use number symbolism to explain a prominent feature of the basilica that appears to have been generated unintentionally by the design process that I have reconstructed.

The notion, developed in Chapter 3, that certain sets of proportions can be considered genuine historical artifacts, and thus can be used as tools to explore an architect's intentions, is pursued further in Chapter 4. Here documents rather than measurements are the main focus of analysis, but the proportional findings from Chapters 2 and 3 nevertheless serve as critical new tools to help resolve several persistent questions pertaining to the construction history of the basilica of San Lorenzo. Progress in resolving the questions of 1) who designed the spatial conception and sets of proportions throughout the basilica, 2) who designed and supervised the manufacture of the sculptural details of the earlier and later portions of the nave arcades, 3) what were the exact location and configuration of the old basilica of San Lorenzo in relation to the new one, and 4) what was the precise sequence of the various stages of construction of the basilica; receive particular impetus from these new proportional findings. This chapter culminates in a detailed chronological narrative of the construction history of the basilica that considers every known piece of evidence that has any relevance to this problem. This construction history may be considered a continuation of the proposed reconstruction of the design process offered in Chapter 2, carrying forward the initial design intentions through the various stages of execution on the site.

Chapter 5 explores yet further the potential value of the study of sets of architectural proportions (proportion-3) in advancing architectural history by using the proportional findings from Chapters 2 and 3 to help identify two likely medieval precedents for various design features of the basilicas of San Lorenzo and Santo Spirito. The apparent influence of one these earlier works, the late-fourteenth century basilica of Santa Maria del Carmine in Pavia, on the Florentine basilicas in question, and on other works in Florence, calls attention to Lombardy as a region of vibrant proto-Renaissance creativity and Roman revivalism that is worthy of increased scholarly attention. The other likely precedent, the nave of the basilica of Santa Maria del Fiore in Florence, by comparison with that of San Lorenzo, illuminates an evident trend toward increasing precision in quantification during the course of the fourteenth and fifteenth centuries—a trend that suggests .

This study concludes, in Chapter 6, by using the weight of the findings presented in the preceding chapters to propose alternatives to the Wittkower Paradigm, since this paradigm is unable to explain these findings. Chapter 6 proposes 1) the notions of increasing precision in quantification, and of “simultaneity” in sets of proportions instead of Wittkower’s separation of medieval geometry and Renaissance number; 2) a rhetorical interpretation of sets of proportions as used in the history of architecture instead of Wittkower’s aesthetic interpretation; and 3) a methodology that blends observation-based and documentary sources instead of Wittkower’s almost exclusively document-based approach.

The appendices include the author’s comprehensive surveys of the basilica of San Lorenzo, including the Old Sacristy, and the basilica of Santo Spirito, and an equally comprehensive *regesto* of all previously-published documents pertaining to the construction history of the basilica of San Lorenzo.

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